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LIGATION OF THE INFERIOR VENA CAVA OR ILIAC VEINS*

A Report of Thirty-Six Operations

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THE first ligations of the inferior vena cava were performed by Kocher in 1883 and Billroth in 1885,[1] these procedures being the results of operative trauma and both being followed by a fatal outcome. The first successful ligation was performed by Bottini.[2] Two ligations of this type were performed in 1906 and a third in 1910 by Trendelenburg,[3, 4] all for thrombophlebitis of the pelvic vein with septicemia, 1 patient recovering. Martens[5] has reported 2 cases of ligation of the vena cava and 9 of the iliac vein for thrombophlebitic pyemia, 7 of the 11 patients surviving. Krotoski,[6] summarizing the literature on the subject in 1937, collected 48 cases of ligation of the vena cava, performed by twenty-seven operators. Homans[7] in 1944 reported 14 cases of surgical interruption of the iliac vein for venous occlusive disease of the lower extremities. In 1945, Kidd[8] stated that successful ligation of the inferior vena cava for traumatic laceration had been accomplished in 9 cases. Shackelford and Whitehill[9] have recently reported a ligation of the left common iliac vein for thrombophlebitis complicated by pulmonary emboli. Gaston and Folsom[10] report 2 cases of ligation of the vena cava for bilateral thrombophlebitis with multiple pulmonary infarcts. Collins[11] performed ligation of the vena cava for pelvic thrombophlebitis in 8 patients with 1 death. Northway and Buxton[12] reported such a procedure in 10 cases — 3 patients having multiple emboli, 4 chronic edema of the legs with ulcerations, 2 swollen and painful legs without ulcers and 1 epigastric pain associated with phlebothrombosis. No deaths occurred in this series. Buxton and Coller[13] reported 7 cases of ligation of the vena cava for bilateral disease of the leg vein and 1 of the iliac vein for unilateral disease. Kern and Berman[14] and O'Neil[15] have also added case reports of ligations of the vena cava.

Thus it may be seen that ligations of the great veins of the pelvis and the inferior vena cava, although not new procedures, are relatively infrequent in clinical application. In recent years, since such great emphasis has been placed on the prevention and treatment of pulmonary embolism, these procedures have become of mounting interest to the clinician and surgeon. Whether medical or surgical therapy will prove to be the more satisfactory solution for the problem probably depends on information to be gleaned from several more years of experience in the many centers interested. Meanwhile, it is imperative that attempts be made to obtain a critical analysis of the two modes of management, their criteria for diagnosis, the indications for whichever therapeutic methods are used by each school, the methods by which these measures are accomplished and the ultimate end-results. It was the aim of the investigation herein presented to provide the conclusions arrived at from the study of 36 cases of ligation of the iliac veins or the inferior vena cava operated on at the Gallinger Municipal Hospital.

The evaluation of any therapeutic approach to the problem of phlebothrombosis must of necessity await the clarification of the diagnosis of its presence. It has been suggested in a previous article[16] that the clinical syndrome of edema, color changes, extensive tenderness, elevated white-cell count and red-cell sedimentation rate and local and systemic fever does not represent an early lesion of bland thrombosis, but rather an advanced state of the disease or a complicating thrombophlebitis. Operative findings in patients of this type demonstrate that the clot encountered in this phase is usually in a varying stage of fixation to the vein wall and has accordingly been rendered relatively innocuous. Phlebothrombosis resembles no other disease so closely as it does cancer in that the most significant phase of the disease occurs during the period when the diagnosis is the most obscure. In the same article, the clinical unreliability of the highly revered Homans's test was discussed and another method of examination was presented. While the aforementioned criteria for diagnosis continue to per-

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vade the literature, it will be impossible to make a just appraisal of any therapeutic measures.

The boundary zone between pure thrombophlebitis with relatively infrequent embolization and phlebothrombosis with its high risk of serious infarction is so broad and yet so vague that even surgical exposure of the clot is sometimes none too satisfactory in settling the issue. This handicap on the surgeon must rest still more heavily on the clinician who deliberately denies himself the certain knowledge of the nature of the disease under treatment. The fallibilities of phlebography were remarked on in the previous publication,[16] and it is notable that this method of examination has suffered a sharp decline in popularity, even among some of its former advocates.[17]

Surgery against Anticoagulants

Although it is not the primary intention of this article to discuss the relative merits of anticoagulants and surgical prevention and therapy of pulmonary emboli from peripheral phlebothrombosis, it may be proper to summarize our present attitude toward these two general methods.

In the first place, the anticoagulants, as represented by heparin and dicumarol, possess a threat of serious hemorrhage. We have witnessed at least 2 deaths that were due to their administration. One might well hesitate to increase deliberately a bleeding tendency in a patient whose lung is already oozing from an infarct or in a pregnant woman who has developed a venous thrombosis. Second, there seems to be good reason to believe that these drugs do not have the ability to affect the clots already formed and that their mode of action can only be on propagation of the existing clot. We have become familiar with the treachery of phlebothrombosis. How can one be assured, having made this diagnosis, that the process will not carry the threat of embolus even if halted exactly at the recognized level in the vein? The danger of the existing thrombus, whether great or small, remains for a period while the physician waits for the clot to adhere to the vein wall. Third, the decision concerning when therapy with dicumarol may be safely discontinued cannot be made on any criteria yet established. It is often necessary to reinstitute its use, and the decision for this appears to depend on the clinical signs of extension of the process, a source of danger in itself. Homans[7] believes that it is impossible to determine by clinical examination whether the process has ceased to extend or is actually extending farther up the vein. Fourth, in contrast, the procedure of proximal venous ligation appears to be more certain, has been repeatedly demonstrated by various observers to be a safe measure, and allows a prompt return to normal existence in the majority of cases, whereas the use of anticoagulants entails the loss of much time and expense and requires the most diligent care during therapy.

Lastly, the greatest objection to surgical management is apparently residual edema following ligation. In regard to this symptom following ligation of the iliac vein and vena cava, another section of this paper will cover its incidence and etiology.

Indications for Ligation of the Inferior Vena Cava

Fully realizing the inevitable state of flux in medical opinion concerning the entire problem of phlebothrombosis, and especially the management of both the local disease and pulmonary emboli, we have attempted to devise a working outline of the criteria on which the decision for ligation of the vena cava may be based. From our own experience, we have tentatively accepted the following indications: thrombophlebitis of the pelvic veins with pulmonary emboli; pulmonary embolus associated with prostatic tenderness of recent, or presumably recent, origin, especially with demonstration of deep tenderness along the anterolateral region of the rectum; reasonably conclusive evidence of pulmonary infarcts the source of which remains obscure despite diligent search; and venous occlusion of the lower extremities that would otherwise be treated by interruption of the femoral vein alone. The conditions governing the last are as follows: cellulitis or lymphangitis of the upper thigh, infections of the groin or the finding of enlarged and tender inguinal or femoral-triangle lymph nodes; recurrent emboli following bilateral ligation of the femoral veins; femoral phlebothrombosis with tense edema extending above the knee; the operative finding of adherent clot on exposure of the femoral vein; and acute thrombophlebitis extending into the upper thigh clinically, with the presence of pulmonary embolism.

In the prevention and therapy of pulmonary embolism, ligation of the inferior vena cava is related to interruption of the femoral vein not as a substitute but rather as a complement. The medical literature is replete with sizable case series proving that femoral ligations are safe, simple and responsible for a significant decline in the mortality from pulmonary embolism. There remain, however, certain conditions under which low ligations do not suffice and higher ligations than those of the femoral veins seem the procedures of choice. Thrombophlebitis of the pelvic veins with pulmonary emboli cannot be properly handled with any surgical intervention less radical than ligation of the vena cava. Krotoski[6] prefers to ligate both iliac and ovarian veins under these circumstances, and ligates the inferior vena cava only if the process has advanced far up the iliac veins. This he accomplishes by celiotomy if a one-stage procedure is practicable or by a two-stage extraperitoneal approach if the condition of the patient is extremely poor. It is difficult to understand why the vena cava should not be ligated primarily rather than both

iliac veins. Also, it is open to question whether ligation of the ovarian veins is necessary, especially since this procedure adds so much to the operation in comparison to the one-stage interruption of the vena cava. No method completely blocks possible transit of emboli from the distal veins, but each method employed merely severs direct communication with the great veins, rendering this mode of transit so tortuous that advance becomes unlikely. Ligation of the femoral veins for peripheral phlebothrombosis is based on this principle, and its effectiveness is beyond question. We have considered ligation of the vena cava alone as adequate and simple, and the results in our few cases seem to support this contention. Among those advocating interruption of the iliac vein and vena cava for embolizing pelvic thrombophlebitis are Bondy, Schottmueller and Beuttner (cited by Ochsner and DeBakey[18]), Huggins,[19] and Martens,[5] who reported such a procedure in 11 cases, with 7 survivals, and Collins, Jones and Nelson,[11] who performed ligation of the vena cava, with 1 death in 8 cases.

In a study of 189 fatal cases of pulmonary embolus, Henderson[20] found that prostatic-plexus thrombi were at fault in 18 cases (10 per cent). Although the diagnosis of prostatic-plexus thrombophlebitis is difficult to arrive at with certainty, it may be suspected in a patient exhibiting emboli, with an enlarged and tender gland and with tenderness and possibly induration extending along the anterolateral aspect of the rectum, especially developing as a recent finding in a patient already under observation in whom no other source of emboli can be detected. Such criteria prevailing, ligation of the vena cava offers the obvious solution.

In the series mentioned above, Henderson also found that 86 per cent of all emboli arose in tributaries of the inferior vena cava. When there is reasonably conclusive evidence of pulmonary infarction, the source of which is obscure, ligation of the vena cava may be the procedure of selection rather than bilateral interruption of the femoral veins especially in patients whose occupation or social status makes persistent edema particularly undesirable. Ligation of the vena cava is appreciably more inclusive in action. Rössle[21] found that in 10 per cent of his cases obscure emboli arose from the veins of the pelvis. Bauer[22] found that in 10 per cent of cases femoroiliac thrombophlebitis began in the deep pelvic veins. Frykholm[23] states that in 16 per cent of his cases of thrombi they occurred in the iliac and pelvic veins.

Not infrequently certain adverse circumstances prevail that contraindicate ligation of the femoral vein that would otherwise be performed. In the presence of cellulitis or lymphangitis of the upper thigh or infections of the groin or the finding of enlarged and tender inguinal or femoral-triangle lymph nodes, often signifying latent regional infection, operations in this area result in a high incidence of wound infection, sometimes of grave import. When we have compromised with this judgment, acute thrombophlebitis has occasionally supervened on the ligated side, probably precipitated by manipulation of the femoral vein in a potentially septic field.

In the earlier days of exploration of the femoral vein we lacked sufficient clinical experience to predict the operative findings from the results of clinical examination. As these findings were more closely correlated, it became evident that tense edema extending above the knee does not occur from a simple phlebothrombosis confined below the inguinal ligament, and that when this type of edema does occur, the clot is too closely adherent to the wall of the femoral vein to permit effective and safe thrombectomy. When these findings are encountered, and if a classical thrombophlebitis can be excluded, ligation of the vena cava is performed as a primary procedure. It is worthy of emphasis that this clinical picture represents gross neglect, and its occurrence in a hospitalized patient is indefensible.

On occasion, following bilateral interruption of the femoral veins, the embolic phenomenon continues and the problem of further management arises. Under these circumstances, it is apparent that the true source of the emboli has been misjudged. This source may be the profunda femoris vein on either or both sides if the superficial femoral veins have been ligated, or it may be the veins of the pelvic viscera. The issue may be so clouded that accurate detection is impossible. Re-entry of the incisions for higher ligation of the common femoral veins will result in edema of major and permanent degree. Ligation of the vena cava provides the most satisfactory solution.

Despite careful preoperative examination, there are times when the operator is taken aback by the operative discovery of adherent femoral clot, even though the bedside examination has revealed almost negligible clinical data. In such a contingency a higher ligation is desirable, preferably without interference with the femoral vessels.

When acute thrombophlebitis of the lower extremity, complicated by embolization, has invaded the upper thigh clinically, there is no surgical alternative to a high ligation.

Iliac-Vein Versus Vena-Cava Ligation

During the earlier stages of our studies, we were inclined toward ligation of the iliac vein in the therapy of apparent unilateral disease not manageable by the femoral approach. Homans,[7] however, has since drawn attention to the likelihood of emboli from the apparently normal contralateral extremity. Among others emphasizing the frequently bilateral nature of the disease are Frykholm,[23] Neumann,[24] Rössle[21] and Gaston and Folsom.[10] It thus seemed that the rationale of iliac ligation was questionable, especially if combined with a femoral ligation on the

opposite side. Ligation of the vena cava is comparable to ligation of either iliac vein, requiring no more anesthesia, exposure, technical skill or time; indeed, it probably requires less of each of these factors than does ligation of the left iliac vein, which is short and lies under the aorta. For these reasons, we have entirely abandoned the iliac approach during the past year.

Operative Procedure

Having used various types of incision in the exposure of these great veins, we have concluded that the following method is the simplest and most satisfactory one. It possesses the basic advantages of the McBurney incision for appendectomy, with no incidence of hernia, wound infection or denervation of the abdominal wall.

The incision, which is usually 9 to 10 cm. in length, is placed 2 to 4 cm. medial to the anterosuperior iliac spine on the right and parallel to the fibers of the external abdominal oblique muscle and fascia. This structure is divided in the line of its fibers, with exposure of the underlying internal oblique and transversalis muscles, which are spread widely to expose the peritoneum. This is swept medially, separating easily from the lateral and posterior abdominal walls and carrying with it the ureter and internal gonadal vessels. The inferior vena cava can be easily visualized. By blunt dissection it is carefully separated from the aorta on the left and the bodies of the lumbar vertebras posteriorly. It is during this mobilization that extreme care must be taken to avoid tearing the lumbar veins, which enter the posterolateral aspect of the vena cava at intervals of 1 to 3 cm. Avulsion of one of these branches results in hemorrhage of the most trying nature. Following complete mobilization of the vein, it is under-run with a ligature carrier and fastened snugly with a nonabsorbable tie. The abdominal wall is closed in layers with interrupted nonabsorbable sutures.

Since the entire procedure is usually completed in ten to fifteen minutes, we have favored spinal anesthesia, utilizing procaine in doses of 40 to 50 mg. This has invariably proved adequate for the operation.

Complaints referable to the operative wound have been notably few and mild, as evidenced by an average of only 1.2 injections of opiate per patient during the postoperative period. There has been no case of ileus, as would be expected in view of the extraperitoneal approach. Any of these patients whose general condition permits can promptly become ambulatory.

There has been no example of shock developing during the procedure, with the exception of a patient who expired at the termination of the closure. Her death, which is discussed in a later section, is believed to have been due to another pulmonary embolus launched before the vena cava was exposed. The amount of blood lost during the entire procedure, provided that the vena cava is carefully handled, does not exceed that lost during a simple appendectomy. In fact, an appendectomy through a McBurney incision seems to be an entirely comparable procedure as regards operative trauma. The mortality attending the procedure is, as Northway and Buxton[12] express it, the result of the disease rather than of the operation itself. O'Neil[15] and Homans[7] have suggested that spinal anesthesia, although preferable from the surgeon's viewpoint, may be hazardous owing to the flexed position assumed during the injection, and believe that general anesthesia may present less objection in this respect. It is also possible that the sympathetic paralysis attending spinal anesthesia may predispose to embolization by sudden relaxation of venous and arterial tone in the extremities. The relaxation of the abdominal muscles obtained by spinal anesthesia, however, is highly desirable. We used intercostal procaine block in only 1 patient (Case 9).

Postoperative edema. Collateral venous return following ligation of the inferior vena cava is much more adequate than one would suppose. O'Neil[15] has divided the collateral pathways into three groups. In the superficial group are the superficial iliac circumflex and superficial epigastric veins connecting the saphenous system with the veins of the abdominal wall and superficial thoracic veins. In the deep group, the deep iliac circumflex, inferior epigastric and lumbar veins connect the external iliac to the internal mammary and ascending lumbar veins. The ascending lumbar trunks begin on either side of the sacral promontory and communicate with the sacral, common iliac, hypogastric and iliolumbar veins. As they ascend, they connect with the lumbar veins, the inferior vena cava and the right renal vein. The right lumbar trunk becomes the azygos vein, and the left the hemiazygos vein. To these groups may be added the vena cava-portal vein communications, particularly the retroperitoneal veins of Retzius, the paraumbilical plexus of Sappey and the superior-middle hemorrhoidal venous anastomosis. In light of these extensive side circuits it is readily seen that the collateral circulation after ligation is potentially enormous. O'Neil states that the edema of the legs following ligation of the vena cava is less than that following ligation of the femoral veins. Gaston and Folsom[10] observed only minimal edema of one leg in 1 of their 2 cases. Kidd,[8] in his report of 9 cases, found no case of persistent edema. Buxton and Coller[13] found less edema after ligation of the vena cava in 7 cases than after the usual femoral-vein procedure. The patient reported by Kern and Berman[14] had no edema up to five months after operation. Collins, Jones and Nelson[11] state that the venous pressure returns to normal in a short time after ligation. Whittenberger and Huggins[25] regard edema as unlikely when the vena cava is ligated

below the renal veins. Pleasants[26] found that sudden occlusion of the lower vena cava failed to produce edema unless the iliac veins were also blocked. Northway and Buxton,[12] however, estimate twelve months as the average time required before venous pressure returns to normal and found that all their 10 patients had mild, but no severe, edema. Two required ligations of varicose veins, and 1 a ligation of distended thoracoepigastric veins after ligation of the vena cava. Homans,[7] recommending ligation of the vena cava if the thrombosis is bilateral and extends to the inguinal ligaments, states his belief that the venous return is poorer than that following iliac interruption because of the loss of the transpelvic venous shunt. Our own findings can be summarized by stating that whenever edema has followed ligation of the vena cava or iliac veins, there has been unequivocal evidence of either persistence or recurrence of the disease process.

Discussion of Cases

In this series are included thirty-six ligations of the inferior vena cava or iliac veins, — 21 of the former and 15 of the latter, most of the latter having been performed during the early studies. These procedures were done on a total of 35 patients, there being 1 patient who was subjected to ligation both of the left common iliac vein and of the vena cava. During the past year, for reasons previously outlined, we have abandoned the iliac approach. Under our present tentative indications, all these 15 patients would have been subjected to ligation of the vena cava.

The conditions necessitating these operations were as follows: recurrent emboli following bilateral interruption of the femoral veins (2 cases; 1 death); thrombophlebitis of the pelvic veins, with infarctions (2 cases; 1 death); pulmonary emboli associated with venous clot fixed to the wall of the femoral vein and extending into the iliac vein (17 cases; 9 deaths); venous clot, adherent to the femoral vein and extending into the iliac vein, without emboli (11 cases; 1 death); phlebitis of the prostatic veins, with emboli (1 case; patient living); pulmonary emboli associated with venous occlusion of the lower extremities, usually treated by femoral interruption, contraindicated by disease in the groin (2 cases; 1 death).

The following are brief abstracts of the cases in which death occurred during the postoperative period.

Case 1 (C10449). A 46-year-old Negress was admitted with and treated for bilateral ovarian abscesses. She pursued a downhill course and developed pelvic thrombophlebitis with multiple pulmonary infarcts. Since her condition was critical, the vena cava was ligated under procaine spinal anesthesia. Sudden shock occurred just as the vein was exposed, the right internal iliac vein clotted, and the patient died as skin closure was being performed, 8 minutes after the operation had been begun. Permission for autopsy was refused. It is believed that the patient had embolus in the operating room.

Case 2 (C6869). A 51-year-old Negress was admitted in congestive failure due to hypertensive heart disease. She developed phlebothrombosis of the femoroiliac vein with multiple infarcts. The vena cava was ligated 15 days after admission, but the patient died 10 days later. Autopsy showed multiple infarcts, cardiac dilatation and thrombosis of the right iliac vein and lower vena cava.

Case 3 (C465). A 63-year-old Negress was admitted with hypertensive heart disease. She developed left phlebothrombosis and multiple infarcts. The left femoral and left iliac veins each contained an adherent clot. The vena cava was ligated, but death occurred 9 days later. The autopsy findings were the same as those in the previous case, together with a dissecting aneurysm of the aorta and bacterial endocarditis.

Case 4 (B99304). A 63-year-old man was admitted with suspected pulmonary infarct or pneumonia. He had an infected toe, enlarged femoral and inguinal lymph nodes and a ++++ edema of the right leg and foot. The vena cava was ligated on the day of admission, but the patient died 7 days later. Permission for autopsy was refused.

Case 5 (B96267). A 72-year-old woman was admitted 1 month after mastectomy for carcinoma of the breast. Swelling of the right leg had developed insidiously at home. There was a +++ edema of the entire right lower extremity. The vena cava was ligated, but the patient died 9 days later. Autopsy revealed thrombosis of the right iliofemoral vein, pulmonary edema and bronchopneumonia.

Case 6 (B93969). A 67-year-old Negro was admitted with multiple infarcts following amputation of a leg for arteriosclerotic gangrene despite prophylactic ligation of the femoral veins. The vena cava was ligated, but the patient died the next day. Permission for autopsy was refused.

Case 7 (B94818). A 53-year-old Negro was admitted with hypertensive heart disease and pulmonary infarct. The left femoral vein contained an adherent clot. The left iliac vein was ligated. The infarcts continued, and the vena cava was ligated 4 days later, but death occurred 8 days later. No autopsy was performed.

Case 8 (B94008). A 54-year-old Negress was admitted with diabetes, infarct, and minimal leg signs. Each femoral vein contained an adherent clot. The vena cava was ligated, but the patient died 28 days later after a septic course. No autopsy was performed.

Case 9 (C17519). A 67-year-old Negress, while under medical investigation for probable carcinoma of the colon, developed insidious edema of the left leg. There was a +++ edema, sudden syncope, cyanosis, dyspnea and semistupor. The vena cava was ligated under intercostal block, but the patient died 3 days later. Permission for autopsy was refused.

Case 10 (B87828). A 40-year-old Negress was admitted with multiple pulmonary infarcts and thrombophlebitis of the right femoroiliac vein. The right common iliac vein was ligated, but death occurred 20 days later. Autopsy showed the above, as well as thrombosis of the cerebral artery.

Case 11 (B94942). A 24-year-old Negress was admitted with far advanced bilateral pulmonary tuberculosis, Pott's disease, spinal fusion, a draining sinus over the site of fusion, possible pulmonary embolus, and phlebothrombosis of the right femoral and iliac veins. The common iliac vein was ligated. The patient died of tuberculosis 14 months later. No autopsy was performed.

Case 12 (C6161). A 54-year-old Negress was admitted with thrombophlebitis of the left femoroiliac vein and multiple infarcts. The left common iliac vein was ligated, but the patient died 6 days later. Autopsy revealed thrombophlebitis of the common iliac vein and multiple pulmonary infarcts.

Case 13 (B94968). A 59-year-old man admitted with hypertensive heart disease developed thrombophlebitis of the right femoroiliac vein, possible multiple infarcts and possible bronchopneumonia. The femoral and iliac veins were thrombosed. The iliac vein was ligated, but the patient died 8 days later. Permission for autopsy was refused.

It is manifestly impossible to evaluate the degree, if any, to which surgery contributed to the death of any of these patients. Their preoperative condi-

tion, as in most of those surviving, varied from extremely poor to critical, most of them having serious cardiac or pulmonary lesions or combinations of the two. One is perched on the horns of a dilemma when he witnesses the sapping of a patient's cardiac and pulmonary reserve from repeated infarctions not amenable to interruption of the femoral vein. The gamble is usually lost in patients as critically ill as those in the cases summarized above. The gloomy picture is considerably brightened, however, when one witnesses the dramatic improvement made by other patients who appear as seriously ill. The essential data accumulated on those who survived are presented in Table 1.

TABLE 1. *Data on 22 Patients Surviving Iliac-Vein or Vena-Cava Ligation.*

Case No.	Hospital No.	Sex	Age	Race	Infarcts	Preoperative Edema	Ligation	Post-operative Edema	Remarks
			yr.						
14	C15614	M	48	W	Multiple	+ (bilateral)	Vena caval	0	Patient with hypertensive heart disease developed multiple infarcts and his condition became critical. There were no leg signs, but there were acute prostatic swelling and tenderness and induration of anterolateral area of rectum.
15	C13401	M	61	N	One	+++ (right)	Right iliac	+ (right)	Patient had insidious swelling of right leg for 2 wk. and chest pain and hemoptysis for 6 hr. before entry. Right common iliac vein was thrombosed.
16	C12902	F	48	N	None	++ (bilateral)	Vena caval	++ (bilat.)	Patient had insidious bilateral swelling of legs 5 wk. after combined resection of rectum. The leg signs were positive, and the iliac veins thrombosed.
17	C9704	M	52	W	None	++++ (right)	Vena caval	0	Patient had insidious swelling of right leg for 3 wk. Right iliac vein was plugged. Patient readmitted for right thrombophlebitis.
18	C8425	F	66	W	One	+++ (right)	Vena caval	0	Patient had had hip nailing 4 mo. previously, with nonunion. Following a massive, nearly fatal, embolus, right leg was swollen.
19	C8234	F	37	N	One	++ (left)	Vena caval	+ (left)	Patient had a massive embolus following an operation for a fibroid uterus and an ovarian abscess. There was swelling of the left calf and the left femoral vein was plugged.
20	C7296	F	58	W	None	++++ (right)	Vena caval	0	Patient had insidious swelling of right leg and thigh during preparation for a gastrectomy. The right iliac vein was thrombosed. Cava later resected.
21	B98021	M	17	N	Questionable	++ (left)	Vena caval	0	Patient admitted with questionable pneumonia or infarct. There was acute swelling of the left foot and calf, and the left femoral and iliac veins were thrombosed.
22	B93383	M	63	N	Multiple	+++ (left)	Vena caval	+ (left)	Patient had cellulitis of left leg and thigh, with repeated infarcts.
23	B93511	F	44	N	Multiple	0	Vena caval	0	The infarcts accompanied a salpingitis, and the patient's condition was critical preoperatively.
24	C11665	M	60	N	None	+++ (right)	Vena caval	0 (2 mo.)	Patient had insidious edema of right leg and thigh 11 days after gastrectomy.
25	C20025	F	42	W	None	0	Vena caval	0 (3 wk.)	Lumbar sympathectomy was performed for thrombosis of right femoral artery. The right iliac vein was also thrombosed, and the cava was ligated at the same operation.
26	B88180	F	40	N	None	++ (left)	Left iliac	+ (left)	Patient had thrombophlebitis of left femoral and iliac veins.
27	B90940	M	30	W	None	+++ (right)	Right iliac	++ (right)	Patient had recurrent femoral phlebitis, with chronic edema.
28	B92500	F	26	N	One	+++ (left)	Left iliac	++ (left)	Patient had postabortal thrombophlebitis of left femoral and iliac veins.
29	B95416	F	68	W	None	+++ (left)	Left iliac	0	Left femoroiliac phlebothrombosis developed following the nailing of a fracture of the neck of the left femur.
30	C5252	F	71	C	One	++ (left)	Left iliac	0	Patient had insidious swelling of left leg following fracture of the right tibia. There was an embolus after bilateral femoral ligation.
31	B87907	F	44	C	Two	++++ (right)	Right iliac	0	Patient had right femoroiliac phlebothrombosis. A left femoral ligation was also performed.
32	B85462	F	66	W	One	+++ (left)	Left iliac	0	A left phlebothrombosis during the course of a meningococcal meningitis.
33	B85427	F	69	W	Multiple	+++ (right)	Left iliac	++ (right)	Patient had a phlebothrombosis of the right leg. The left femoral vein was filled with an adherent clot. A right femoral ligation was also performed.
34	B81965	F	36	W	None	+++ (right)	Right iliac	0	An insidious swelling of the right leg followed a thoracic empyema. The right femoral vein was filled with adherent clot.
35	B90320	F	71	W	None	+++ (right)	Right iliac	+ (left)	An intertrochanteric fracture of the left femur was followed by insidious swelling of the right leg. The right femoral vein was filled with adherent clot. Right and left femoral ligations were also performed.

Summary

The history of operative interruption of the inferior vena is reviewed.

A tentative list of the criteria for ligation of the vena cava is presented and discussed.

The reasons for the recent abandonment of the iliac approach are enumerated.

The operative technic of ligation of the vena cava is described, and the incidence and etiology of postoperative edema of the extremities are discussed.

Abstracts of the case histories of the 13 patients who died following operation and the essential data on the 22 who survived are presented.

References

1. Pfaff, O. G. Ligation of inferior vena cava. *Am. J. Obst. & Gynec.* **11**: 660-663, 1926.
2. Costa, G. Contributo allo studio delle ferite della vena cava inferiore. *Arch. ital. di chir.* **4**:?39-388, 1921.
3. Miller, C. J. Ligation or excision of pelvic veins in treatment of puerperal pyaemia. *Surg., Gynec. & Obst.* **25**:431-452, 1917.
4. Hartmann, J. Puerperaler Pyämie die Unterbindung der Vena cava inferior. *München med. Wchnschr.* **58**:711, 1911.
5. Martens, E. Die Gefässversorgung in der Leber als Beitrag zur Frage der Lappenresektion. *Verhandl. d. deutsch. Gesellsch. f. Chir.* **45**: 246-249, 1921.
6. Krotoski, J. Zur Venenunterbindung bzw.-exstirpation bei der puerperalen Allgemeininfektion vom chirurgischen Standpunkt. *Chirurg.* **9**:425-439, 1937.
7. Homans, J. Deep quiet venous thrombosis in lower limb: preferred levels for interruption of veins: iliac sector or ligation. *Surg. Gynec. & Obst.* **79**:70-82, 1944.
8. Kidd, H. A. Suture of laceration of inferior vena cava due to bomb splinter. *Brit. J. Surg.* **32**:508-510, 1945.
9. Shackelford, R. T., and Whitehill, R. Successful ligation of left common iliac vein for thrombophlebitis complicated by pulmonary emboli. *Bull. Johns Hopkins Hosp.* **73**:307-312, 1943.
10. Gaston, E. A., and Folsom, H. Ligation of inferior vena cava for prevention of pulmonary embolism: report of two cases. *New Eng. J. Med.* **233**:229-233, 1945.
11. Collins, C. G., Jones, J. R., and Nelson, E. W. Surgical treatment of pelvic thrombophlebitis: ligation of inferior vena cava and ovarian veins: preliminary report. *New Orleans M. & S. J.* **95**:324-329, 1943.
12. Northway, R. O., and Buxton, R. W. Ligation of inferior vena cava. *Surgery* **18**:85-93, 1945.
13. Buxton, R. W., and Coller, F. A. Surgical treatment of long standing deep phlebitis of leg. *Surgery* **18**:663-668, 1945.
14. Kern, H. M., and Berman, E. Ligation of inferior vena cava for pneumonic thrombophlebitis. *Am. J. Surg.* **69**:120-125, 1945.
15. O'Neil, E. E. Ligation of inferior vena cava in prevention and treatment of pulmonary embolism. *New Eng. J. Med.* **232**:641-646, 1945.
16. Moses, W. R. Early diagnosis of phlebothrombosis. *New Eng. J. Med.* **234**:288-291, 1946.
17. Fine, J., and Starr, A. Surgical therapy of thrombosis of deep veins of lower extremities. *Surgery* **17**:232-239, 1945.
18. Ochsner, A., and DeBakey, M. Thrombophlebitis and phlebothrombosis. In *Practice of Surgery*. Edited by Dean Lewis. Vol. 12. Chap. 5-B. Hagerstown, Maryland: W. F. Prior Company, Inc., 1944.
19. Huggins, R. R. Ligation or excision of ovarian or deep pelvic veins in treatment of puerperal thrombophlebitis. *J. A. M. A.* **59**:160-165, 1912.
20. Henderson, E. F. Fatal pulmonary embolism: statistical review. *Arch. Surg.* **15**:231-236, 1927.
21. Rössle, R. Ueber die Bedeutung und die Entstehung der Wadenvenenthrombosen. *Virchows Arch. f. path. Anat.* **300**:180-189, 1937.
22. Bauer, G. Venographic study of thrombo-embolic problems. *Acta chir. Scandinav.* (Supp. 61) **84**:1-75, 1940.
23. Frykholm, R. Pathogenesis and mechanical prophylaxis of venous thrombosis. *Surg., Gynec. & Obst.* **71**:307-312, 1940.
24. Neumann, R. Ursprungszentren und Entwicklungsformen der Bein-Thrombose. *Virchows Arch. f. path. Anat.* **301**:708-735, 1938.
25. Whittenberger, J. L., and Huggins, C. Ligation of inferior vena cava. *Arch. Surg.* **41**:1334-1343, 1940.
26. Pleasants, J. H. Obstruction of inferior vena cava with report of eighteen cases. *Johns Hopkins Hosp. Rep.* **16**:363-548, 1911.

NEUROPSYCHIATRY IN THE EUROPEAN THEATER OF OPERATIONS

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THE best way to present this subject is to do it chronologically, discussing various topics just as they developed in the theater. Neuropsychiatric services in the European theater were at all times a part of the general medical services. For example, in the Division of Professional Services of the Office of the Chief Surgeon, the senior consultant of neuropsychiatry functioned under the chief consultant in medicine. Also, in all hospitals the Neuropsychiatry Section was part of the division of the medical service. The term "neuropsychiatry" was maintained in keeping with the practice of not separating neurology and psychiatry except for those aspects of neurology that fell within the neurosurgical services.

The year 1942 was a ground-laying period in which the foreign theater had comparatively few troops, most of whom were in North Ireland. By the end of the year six general hospitals were in operation and all psychiatric services were centered in these hospitals. None of these hospitals, however, had wards that were specifically designed for neuropsychiatry. Accordingly, plans were drawn so that one medical ward in each general hospital would be converted into a ward for neuropsychiatric patients. This plan was adopted for all the general hospitals that were being built in England for the United States Army. The policy of maintaining inpatient, outpatient, rehabilitation and consultation neuropsychiatric services in all station and general hospitals was adopted quite early. As the number of general hospitals increased, personnel problems, especially so far as neuropsychiatrists were concerned, developed here and there, and at times the Neuropsychiatric Section was headed by a medical officer who had had little experience in psychiatry. This was corrected as soon as possible, and for the most part the services in general and station hospitals were adequately handled.

To keep neuropsychiatry intimately related to and part of general medicine was considered extremely important. This was in keeping with the definite trend in civilian as well as military medical practice. Steps to establish entirely separate hospital units for neuropsychiatry were taken with reluctance and caution, regardless of the experience in the last war and the experience of the British in this war. It appeared to be a backward step, but since the American general-hospital installations had only improvised facilities at the time for psychotic patients, it was evident that special provision had to be made. Future developments revealed that for the nonpsychotic patient there were many advantages in a separate mental-rehabilita-

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tion unit. In a neurosis or mental-rehabilitation hospital where the patient did not come in contact with physically sick or wounded soldiers the atmosphere of recovery and return to duty could be created and carried on from admission until final disposition. Although the general and station hospitals carried out the same technics of treatment and rehabilitation, the total atmosphere could never be captured. Few of the general hospitals approached the return-to-duty rate of the special neuropsychiatric hospitals, and the latter usually received only the patients whom the general hospitals had been unable to return to duty. Fortunately, the special neuropsychiatric hospitals were large enough to include medical, surgical, x-ray, laboratory and dental services that were at least equal to those found in many other hospitals.

Before the arrival of the senior consultant in neuropsychiatry, steps had been taken to procure a British mental hospital at Exeter, with the object of having a holding place for psychotic patients. This hospital was opened for patients on January 23, 1943. The 36th Station hospital, a special neuropsychiatric unit under the command of Colonel Ernest H. Parsons, arrived just in time to start this function. This was a 250-bed unit, and the installation had room for 350 patients.

Within a month a special rehabilitation section, called the Training Company, was established. It was organized on a strictly military basis, with a captain from the Air Corps, who was a patient, as commanding officer. The wards were turned into barracks and the entire program throughout the day was on a military basis. The daily schedule included reveille, setting-up exercises, drill, military training, athletics and assignment of work details. There was a great variety of work assignment, such as repair of buildings and roads and the erection of garage and post exchange buildings. All occupational therapy was concerned with constructive activities that improved the installation. Group discussions and information and education activities were included in the program. Without too much difficulty a return-to-duty atmosphere was created. The results were soon evident in hospital statistics with a return-to-duty rate for nonpsychotic patients of over 50 per cent.

In March, 1943, plans were begun to have a separate and larger neurosis hospital. This was accomplished by the following November, and the 312th Station Hospital was made over into a neuropsychiatric unit. The plan of function that had been evolved at the 36th Station Hospital was adopted. After the initial work-up of each case, with a decision as to type of treatment, the patient spent between ten days and two weeks in the treatment section. Following this he was transferred to the training or rehabilitation wing, which was the needed step between hospital care and duty. At this hospital the return-to-duty rate averaged 80 per cent. It must be kept in mind that patients were received only after general hospitals had failed to return them to duty.

As a result of this experience and for various other reasons, it was decided that a similar neuropsychiatric unit should be formed to function on the Continent just in the rear of the Army. Accordingly, the 130th General Hospital, which arrived on August 1, 1944, was remade into a neuropsychiatric unit. As such it arrived in France on September 4, 1944, but because of loss of equipment was not able to start functioning until November 17. It was located at Ciney, Belgium. At first it was in a good position to receive all the neuropsychiatric patients coming out of the First and Ninth Armies, but because of an overflow of medical and surgical cases from the Liège area it did not begin to function as a neuropsychiatric unit until December 1. Then came the Battle of the Bulge, and by December 20 it was evident that this hospital would be in the center of the German drive. The commanding officer, Colonel Parsons, evacuated most of the patients and his staff, remaining behind with a few volunteers to care for nontransportable patients. Just before Christmas, the hospital was practically surrounded and the main road of escape was cut. German officers requested that adequate care be given wounded Germans, and this was done. Before the end of the year the German retreat had started, and by January 2, 1945, it was possible to bring back the staff and the hospital continued to function. At that time it was in front of the aid stations, but it soon became a field hospital, then a clearing station and later an evacuation hospital. During the latter part of January and during February it had to function as a regular station hospital. By the time its primary function as a neuropsychiatric unit was resumed the armies were beyond the Rhine and evacuation was being done almost entirely by air. This meant that all patients were flown beyond the area in which this hospital was located, the majority coming to Paris. During the periods that this hospital was able to function as a neuropsychiatric unit it was able to return 90 per cent of its patients to duty.

A similar unit, the 51st Station Hospital, came to the Continent from North Africa and served the Third and Seventh Armies. This hospital met the same fate that befell the 130th General Hospital. During the Battle of the Bulge it was necessary for it to do surgical work. Also, in the spring of 1944 patients were being flown from beyond the Rhine to the Paris area. This hospital when fully functioning as a neuropsychiatric unit also returned 90 per cent of its patients to duty. Before either of these hospitals could be moved forward, V–E Day came and the care of neuropsychiatric patients was centered in a general hospital in Paris.

Before leaving the subject of special neuropsychiatric units, mention should be made of the School of

Neuropsychiatry, which was really a part of the neuropsychiatric units. This was first opened in April, 1943, at the 36th Station Hospital under the direction of Lieutenant Colonel Jackson Thomas. At first neuropsychiatrists coming into the theater with general and station hospitals were given a one-month course. Along with this went courses for nurses and enlisted men working in neuropsychiatric sections of general and station hospitals. Also, during the summer of 1943, several courses, each lasting one week, were given for medical officers of ground force units. In September, 1943, Colonel Thomas was recalled to the Zone of the Interior, and it was not until late in the year that Major Howard Fabing arrived to take his place. The school was then moved to the 312th Station Hospital and practically all the instruction was given to front-line medical officers. Weekly classes were held for these men until the middle of July, 1944. As a part of the services to ground-force units it was necessary to train approximately 15 division psychiatrists. In addition to this, neuropsychiatrists, nurses and enlisted men from evacuation hospitals and other forward units were given definite courses of instruction. Approximately 700 medical officers who later worked in aid collecting or clearing stations were given the one-week course in what was called "first-aid psychiatry." The total number of persons attending this school was approximately 1200. A feature of the school was a weekly tent show in which conditions at the front were simulated and various syndromes of combat exhaustion were acted out and treated.

Before turning to the psychiatric services in the Army, mention should be made of the fact that there were psychiatric services in the two large reinforcement depots that handled patients going back to duty from hospitals. Also, the disciplinary training centers had psychiatric services. Mention should also be made of the Recovery Center, although there was no psychiatrist there. This was a training unit, with rather strict military discipline for the unwilling soldier. Trainees were carefully selected after thorough neuropsychiatric study, and it can be stated that this unit made good soldiers out of the majority of the trainees.

It has already been mentioned that the majority of medical officers who were dealing with casualties at the front had a course in first-aid psychiatry. This included prevention as well as early treatment. Also, line officers with combat units were instructed in various ways by Army and division psychiatrists. It can be stated that the division psychiatrist was the keystone of the psychiatric services in combat units. Every division had one. He functioned mainly at the level of the clearing station, where he had one or two tents separate from others for combat-exhaustion patients. An important part of his work was to see that the medical officers in front of him functioned efficiently. Quite early in combat it was recognized that a division psychiatrist who was having a large percentage of men returned to duty from the clearing station was not doing a good job forward. Numerous examples could be given in which a division psychiatrist had a low rate of return to duty only because medical officers ahead of him sent him only the most difficult cases.

It was originally planned to have psychiatric services in evacuation hospitals, to carry on further study and treatment of patients whom the division psychiatrist had been unable to return to duty. This was the arrangement that existed in the North African theater until November, 1943. At that time the surgeon of the Fifth Army made the suggestion that the Army clearing station be used as a separate neuropsychiatric unit to relieve crowding in evacuation hospitals. The advantages of this arrangement were obvious, and this recommendation was brought back to the European theater of operations. Usually an evacuation hospital is looked on as being primarily a surgical hospital, and when it is crowded the transportable patients, especially the ambulatory ones, are sent farther to the rear to make room for the seriously wounded.

Recognizing this possibility, the First Army some months before D Day organized an exhaustion center. This was a makeshift organization using a clearing company as the housekeeping unit, which was augmented by bringing in psychiatrists from evacuation hospitals on detached service. The plan of service and treatment was essentially the same as that described above for the larger neuropsychiatric hospitals in the communications zone. About two weeks after D Day, the exhaustion center of the First Army was functioning on the Continent. By the end of July, it was necessary to establish a second exhaustion center in the First Army, and early in August each of these exhaustion centers had approximately 1000 patients. It is obvious that the evacuation hospitals could not have handled this case load and that the majority of patients would have been evacuated to the hospitals in England.

The Ninth Army adopted this same plan, and the Seventh Army had been using such an arrangement before it came into France. The Third Army differed in that psychiatrists were kept in the evacuation hospitals, but these units were backed up by a special neuropsychiatric section in the convalescent hospital. For the Third Army with its particular type of combat, which was mostly rapid advance, this arrangement worked extremely well. In the end it was decided by most neuropsychiatrists who had had experience at the front that the exhaustion center should be established as an official part of the medical services of each army.

One could go into great detail in describing the various types of neuropsychiatric conditions seen under combat, but only a brief account can be given here. As is well known, the term "combat exhaus-

tion" was the only diagnostic label placed on the emergency medical tag of the neuropsychiatric patient at the front. This diagnosis was not changed unless he was evacuated. There is no doubt that in a few cases a more specific diagnosis could have been made right at first, but in the vast majority of cases this proved to be an excellent term. Naturally, the soldier read his diagnosis and the term "exhaustion" suggested to him a natural occurrence and speedy recovery. Treatment, too, was essentially that of overcoming an exhausted state and included sedation, food, sleep and reassurance. In the majority of conditions arising under combat conditions purely physical causative factors could not be separated from emotional and psychologic factors. The two were mutually contributory, one to the other. The vast majority of men coming back from combat with nervous symptoms were exhausted, and the majority of thoroughly exhausted men showed unsteadiness and even tremors, loss of efficiency, disturbed digestion and complaints of headache, bodily aching and loss of strength. These are the very symptoms seen in the more outspoken neuroses. In ordinary life, fatigue brings aching muscles; the tired business man is irritable; the exhausted child cannot fall asleep; strain often produces headache; and long hours of work lead to lowered efficiency. Usually the psychologic factors are more important, but there is such a thing as exhaustion of psychologic and emotional functions.

Any classification of type of cases is apt to be misleading because within a few hours or a day or two one type often changed into another, and still later and farther back one frequently saw a clinical picture that did not resemble the initial one.

By far the most frequent conditions found were the anxiety conditions. These can be divided into the highly acute and the subacute. In the highly acute conditions there was either panic or freezing. There is no need to describe these in detail, except to say they were extremely disconcerting to others. In the subacute conditions, rhythmic tremor was usually outstanding and a startle reaction was prominent. These soldiers looked exhausted and gave a history of having had little sleep and a loss of appetite. For many of them, battle dreams were quite disturbing.

At the front, clear-cut hysterical conditions were not so frequent as might have been expected, judging from the history from the last war. The obvious hysterical paralyses were in the minority, and the most frequent hysterical symptom was amnesia. After this came loss of voice or stuttering, and there were occasional patients with hysterical blindness or deafness. Not infrequently a patient who had first appeared with an anxiety condition later showed some hysterical symptoms as his outspoken anxiety symptoms diminished.

After a unit had been in combat for a long time, the proportion of patients with what was called "reactive depression" increased. These syndromes came mostly in conscientious noncommissioned officers who had been at the front for a long time. They appeared definitely exhausted and depressed, with self-accusatory trends. Mention should also be made of the pseudopsychotic cases. These patients seemed hallucinated and disoriented and sometimes presented a typical catatonic picture. The psychotic symptoms rapidly subsided but often left anxiety or hysterical syndromes.

In discussing the topic of treatment it is appropriate to consider prevention because there is no distinct dividing line between prevention and treatment. As stated above, line officers as well as all division medical officers had some indoctrination in prevention and early recognition of combat exhaustion, but perhaps not enough. In this training, emphasis was placed on the quality of leadership as a primary factor in prevention. It was considered important that soldiers be fitted into their proper assignment so the job was neither too big nor too little for their abilities and training. Selection, classification and assignment was considered a continuing process in all units. Adequate training, indoctrination and discipline were important because they added to the soldier's confidence in taking care of himself. Another item in prevention was the way in which reinforcement troops were introduced into the unit during fighting. The problem of providing adequate rest periods for smaller or larger units was a topic of constant discussion. Rest periods were instituted wherever the tactical situation allowed. It was considered better to do this than to wait for the soldier to become a medical casualty. Such rest periods gave him something better to look forward to than death, maiming or a psychiatric breakdown. The medical officer with combat troops was schooled to be on the lookout for the man who was getting jumpy, going off by himself, becoming sleepless, losing his appetite or showing other symptoms of undue strain. He was urged to see that his men were as comfortable, well fed and clean and dry as possible under any given set of circumstances. He was also told that a good medical officer had an interest in the soldiers' everyday life, in their sports and in their equipment and that he had to share their dangers and hardships.

Concerning treatment more specifically, the front-line medical officers did recognize early symptoms, and the usual procedure was to send the soldier back to the kitchen area or some similar place where he could have a good sleep, perhaps with a little sedation, one or two hot meals and a chance to wash, shave and dry his clothing. Of course the personal contact, the explanation and reassurance given and the temporary relief from constant vigilance were important factors in this first-aid work. Just how many men were so treated and returned to duty the following day is not known because no records could be kept, but there were cer-

tainly many of them. Several division surgeons told me that at least 50 per cent of the combat-exhaustion patients were returned to duty in this way.

If the symptoms were too pronounced for this simple treatment, the soldier was evacuated, under sedation, to the clearing station. Sedation during this process seemed to render the job easier and made the patient more comfortable. Certainly patients arriving at the clearing station under sedation were in much better condition than those sent back without it. Also, it appeared that fixation of symptoms was in some measure prevented.

At the clearing station the patient was kept under the care of the division psychiatrist for two to four days. For the majority of patients so held, sleep during the first twenty-four to thirty-six hours was assured, with due attention to nutrition. Sodium amytal was used, so that the patients slept through the night and had a nap in the forenoon and afternoon. At least another day was given to occupation, recreation and group or individual talks. In some divisions more extensive rehabilitation programs were tried. At this level, hysterical symptoms usually responded readily to suggestive therapy, with or without the aid of drugs.

At the exhaustion center the patients could be held longer — for seven to ten days — and the treatment, especially the rehabilitation program, could be carried out much more thoroughly. Moderate sedation was used for the first few days, and occasionally modified insulin therapy was employed. Group psychotherapy and individual psychotherapy where indicated were considered of the greatest importance.

Reference to treatment in the neuropsychiatric units in the Zone of Communications has already been made. Moderate sedation therapy was extensively employed, but this was frequently combined with modified insulin therapy. Group and individual psychotherapy often started with the above treatment and was always carried on so far as necessary or so far as time permitted. In individual psychotherapy, Sodium Pentothal abreaction was used more frequently than was hypnosis. Some neuropsychiatrists thought that group psychotherapy was the most valuable of all forms of treatment. Others thought that in the majority of cases the individual working out of problems, with or without drugs or hypnosis, was necessary. The modified insulin therapy, which was undoubtedly instrumental in the gain in weight and physical well-being, could not have been left out in the majority of cases. It can be added that without the rehabilitation program the return-to-duty rate would not have been nearly so high.

Regardless of what type of treatment was the most efficacious, it is known that within Army psychiatric services, 60 per cent of the patients were returned to active duty, and that the majority of them resumed combat duty. This does not count the patients who were returned to duty up forward at the aid stations. At this rate, 40 of every 100 patients came back to the Zone of Communications. There the neuropsychiatric hospitals were able to return approximately 80 per cent to duty, but mostly noncombat duty. This leaves only 8 or 10 of the original 100 patients for evacuation to the Zone of the Interior. Among these were a few psychotic and epileptic patients and others who could not possibly be reclaimed for service.

There are many more interesting topics that might be discussed, such as morale, individual case studies, motivation of the soldier, selection and placement and personality factors in those suffering breakdowns. All these topics deserve separate papers. It is hoped that the above description has given some idea of the over-all developments in neuropsychiatry in the European Theater of Operations.

INFECTIOUS DIABETIC GANGRENE OF THE SKIN OF THE NECK

Report of a Case

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WHEN diabetes mellitus and gangrene are associated, one usually thinks of this combination in relation to the extremities, along with arteriosclerotic peripheral vascular disease. Gangrene of other parts of the body is considered to be a rare complication of diabetes mellitus. Nevertheless a growing, if scattered, literature on this complication is accumulating. There has been reported diabetic gangrene of the nasal septum and turbinates,[1–5] the orbit and nares,[5, 6] the nares alone,[7, 8] the right half of the tongue,[6] the lip,[9] the skin of the entire body,[10] the face,[5, 6, 11–13] the lung,[14] the vulva[15] and the glans penis and urethra.[16]

It is our purpose to report a case of diabetic staphylococcal gangrene of the skin of the entire neck. This complication of diabetes mellitus presented some interesting features regarding the differential diagnosis, the prognosis and, in particular, the treatment.

CASE REPORT

J. H., a 51-year-old salesman, was admitted to the South Nassau Communities Hospital in Rockville Centre, New York, on May 5, 1944. His illness began 10 days before admission, when he noted some pain in the back of the neck, which progressed to redness and swelling. The pain and swelling, which had begun at the nape of the neck, spread over the entire neck, and the patient began to run a fever. He treated himself with hot compresses, and 2 days before admission consulted one of us (R. T. D.), who suspected a beginning carbuncular lesion secondary to diabetes mellitus and advised hospitalization. No history of trauma could be obtained.

The past history revealed diabetes of many years' standing. Twelve years previously the patient had an abscess on his forehead, which was extremely painful and slow to heal. The family history was noncontributory.

Physical examination revealed an obese, stocky man. It was essentially negative except for the obesity, a heart that was enlarged to the left, a blood pressure of 180/94 and the neck lesion. The patient appeared acutely ill.

The lesion on the neck extended from slightly above the hair line to the shoulders and laterally around to the line of the ear lobes on both sides. It was raised but flat and was red and brawny in appearance. There was no sharp line of demarcation. There was no evidence of the typical multiple-headed boil characteristic of carbuncle. The red-cell count was 4,500,000, and the hemoglobin 12.6 gm. The white-cell count was 25,000, with 80 per cent neutrophils, 13 per cent small lymphocytes, 5 per cent monocytes, 1 per cent basophils and 1 per cent eosinophils. The urine contained 10 per cent sugar and gave a ++++ test for acetone; the test for diacetic acid was negative. The blood-sugar level was 200 mg. per 100 cc.

The patient was treated vigorously for diabetic acidosis with insulin and intravenous fluids. Seven days after admission the urine was clear of sugar and acetone. The patient ran a septic temperature ranging from 99 to 104°F.

Shortly after admission the red, brawny area suddenly became cyanotic and in 24 hours it became gangrenous. The gangrene was sharply demarcated. Small, scattered crops of blebs filled with fluid appeared; these soon broke and began to discharge pus. A culture of this material revealed *Staphylococcus albus* and *Staph. aureus*. The patient was seen by one of us (J. M.), at which time a diagnosis of diabetic staphylococcal gangrene of the skin was made. Conservative treatment was advised, inasmuch as the diagnosis of carbuncle of the neck had been entertained and surgical treatment was anticipated. The lesion did not present any of the characteristics of the multiple-headed boil discharging pus from many openings that is usually associated with carbuncle.

Further laboratory studies of the blood and urine are shown in Table 1.

At first, boric acid wet dressings were applied locally to the gangrenous areas with the intention of localizing the infection, without effect. For a while there was mild drainage from the blebs.

On the 5th day after admission, treatment with penicillin was begun. A dose of 1,300,000 units was given intramuscularly in the buttock and locally around the lesion during a period of 3 days. In the last few days of hospitalization only dry dressings were used. The temperature, which had been ranging up to 104°F., dropped to 101.2° for 2 days and after the 7th day averaged 100.4° for 3 days and 100° for 10 days. It was normal on the day of discharge, March 25. The patient left the hospital with the entire back of the neck covered with a typical dry, purple gangrene (Fig. 1), which was as extensive as the day the neck became gangrenous.

TABLE 1. *Laboratory Data.*

	URINE			BLOOD SUGAR
	SUGAR	ACETONE	DIABETIC ACID	
				mg./100 c.
5-8-44	4%	++++	++	
5-11	2%	++	0	
5-12	Trace	0	0	190
5-13	0	0	0	
5-15	0	0	0	220
5-18	0	0	0	
5-22	0	0	0	190
5-26	0	0	0	102

The patient was last seen on July 11, 1944, at which time the faintest blush could be seen where the former area of gangrene had been (Fig. 2). There were a few scattered punctate areas, where former blebs were still in the process of granulation. Aside from this the skin appeared normal. The diabetes was under control, and the patient was quite well.

DISCUSSION

The clinical diagnosis of diabetic staphylococcal gangrene of the skin offers little difficulty once the gangrene appears. In the early stages of the infection it may be mistaken for erysipelas. This diagnosis has been made on several occasions.[6–8, 11] Another lesion that resembles erysipelas in its early stages and later becomes gangrenous is hemolytic streptococcus gangrene of the skin, described by Meleney.[17] The differentiation is established by bacteriologic examination.

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The mechanism producing this type of gangrene is distinct. Buerger,[18] in describing the diagnosis and pathologic process of the so-called "diabetic gangrenes," draws attention to four distinct varieties of the disease—the arteriosclerotic, the thrombotic, the embolic and the thromboangiitis obliterans form. The essential features of these types may be described briefly as follows: The arteriosclerotic type occurs in persons of advanced years and involves the larger arteries, especially those of the periphery, in vessels that are the site of advanced arteriosclerosis. It is characterized by proliferation of the endothelial lining, with an increase of the subendothelial connective tissues, as well as by fatty degeneration, with the deposition of fat, lipoids and cholesterol. The necrosis is associated with atrophy and calcification of the tunica muscularis and the tunica adventitia, leading to occlusion.

Thrombotic gangrene occurs in vessels that are the site of arteriosclerosis of a mild degree and is characterized by sudden occlusion as a result of thrombus formation. This type likewise is most frequent in the peripheral vessels. Embolic gangrene is a sequel to the lodging of an embolic mass, which is frequently carried from some distant focus and when infected leads to suppuration, abscess formation and gangrene. This type of gangrene may occur in vessels that are otherwise normal. Thromboangiitis obliterans is characterized by involvement of the superficial veins and arteries by an acute inflammatory process, resulting in thrombus formation and subsequent occlusion.

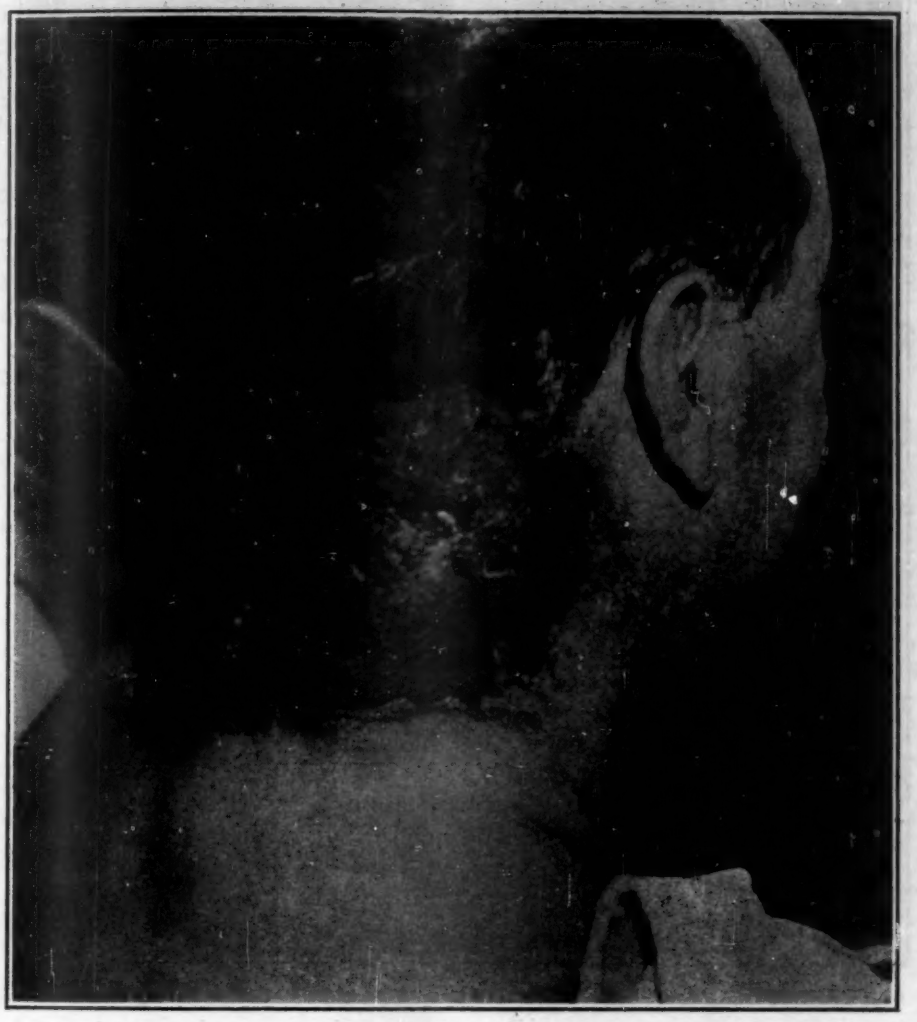

FIGURE 1. *Photograph Taken Several Days before Discharge from the Hospital.*

There are several predisposing factors to be considered in the production of diabetic gangrene of the skin. First of all, there is the diabetic patient, who is always susceptible to infection. Trauma to the skin, however slight, may be a precipitating factor. The ever-present staphylococcus needs little more encouragement for invasion under such circumstances. The resulting brawny inflammation and edema may produce an arteritis of the terminal ves-

sels in the skin, with thrombosis and subsequent gangrene of the parts supplied.

The edema beneath the surface of the lesion may lend a misleading appearance regarding the depth of the gangrene. The gangrene in the present case must have been superficial indeed to have cleared a large crater with undermined edges. Occasionally in this type of lesion one sees small areas of gangrene of the skin about the edge of the crater.

Unlike diabetic gangrene of the extremities, age apparently plays no role in this type of gangrene. The youngest patient on record was four years of

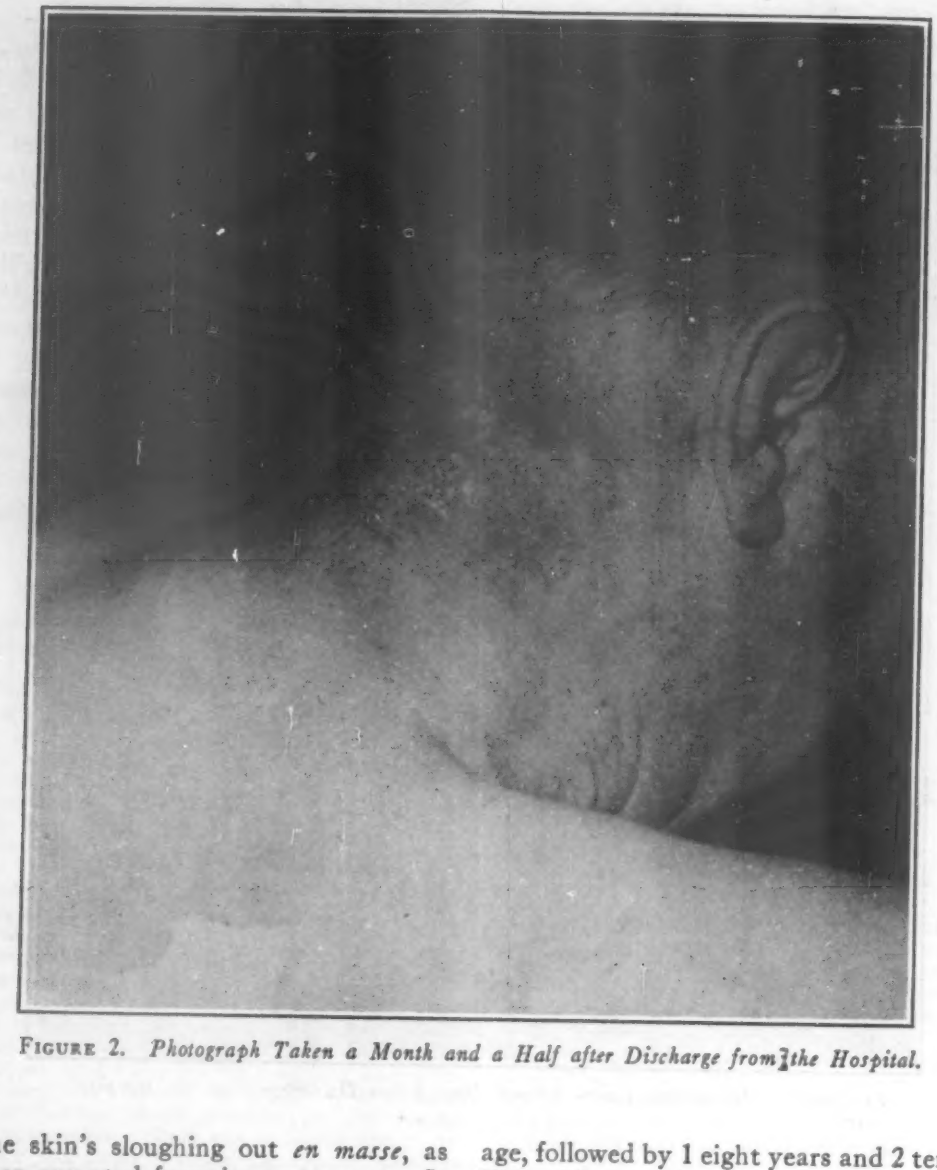

FIGURE 2. *Photograph Taken a Month and a Half after Discharge from the Hospital.*

up without the skin's sloughing out *en masse*, as might have been expected from its appearance. It was only in the scattered areas where the blebs containing clear fluid appeared, later to discharge pus, that the gangrene was deep enough to produce actual necrosis of the entire depth of the skin, with subsequent replacement by scar tissue. These areas were small as compared to the actual amount of skin surface involved. From a pathological and clinical point of view, this tends further to distinguish this lesion from carbuncle, in which there is usually a large central necrotic area discharging pus from many small openings in the skin. This deep necrotic lesion if left alone eventually sloughs out and leaves

age, followed by 1 eight years and 2 ten years of age. The oldest patient was sixty-five years of age.

The prognosis of diabetic gangrene of the skin is uniformly favorable. The only exceptions are the lesions that involve the cheek over the malar areas. The lesion in this location easily spreads into the blood vessels leading inside the skull, resulting in cavernous-sinus thrombosis, brain abscess and meningitis or drainage into the general circulation with bacteremia and metastatic abscesses. All these patients have died.[5, 6, 11, 12] All patients with lesions involving other areas about the head, the nasal septum and turbinates, the hard palate, the eyelids, the skin of the nose and ears, the lip and

the tongue have recovered, with one exception (Bowers's[5] Case 1), and this death occurred in the pre-insulin era.

The complications following diabetic gangrene of the body surfaces depend on the extension of the lesion to adjacent structures. Thus, in Morris's[1] case, involvement of the turbinates and septum was complicated by involvement of the adjacent sinus and the third, fourth and ophthalmic branch of the fifth and sixth nerves. In Briers's case, involvement of the skin of the ear and the area anterior to it was complicated by involvement of the fifth and seventh nerves. In Ardeshir's[8] case, gangrene of the skin of the nose was accompanied by destruction of the underlying cartilage of the nasal alae, whereas Wood's[7] case resulted in spontaneous amputation of the entire nose and the loss of the nasal septum and the nasal processes of the superior maxilla and nasal bones. Goldberg's[3] case of gangrene of the nasal cartilage and right middle and inferior turbinates resulted in osteomyelitis of the right orbit, and Speidel's[4] case of gangrene of the nasal septum ended with atrophy of the right optic nerve. Millett[11] has shown in his 2 cases of gangrene of the cheek that where the extension of the infection had involved the general circulation, positive blood cultures for staphylococci were obtained, and that in the case that came to autopsy metastatic abscesses were found in the lungs. The organisms cultured from the cheek lesion and from the blood stream were identical.

The proper treatment of diabetic gangrene of the skin is both general and local. The diabetes and any acidosis present must be controlled by insulin, fluids and dextrose. Local treatment should in the main be conservative. Watchful waiting is probably the procedure of choice. Wet dressings and careful removal of slough as it occurs can be done as needed. Penicillin may well prove to be a life-saving procedure when septicemia is present. It should be used at all times in these cases, since it may well prevent such a complication. Drastic surgery should not be done, since it may open up new channels for systemic invasion by organisms.

Summary

A case of extensive infectious diabetic gangrene of the skin involving the entire neck is reported. The patient recovered.

Infectious diabetic gangrene of the skin may be considered as a separate clinical entity having a distinct clinical course and a definite pathology.

In differential diagnosis it must be considered with erysipelas in its early stages and carbuncle in its later stages.

Conservative treatment should be given. Penicillin may be life-saving in preventing septicemia or in overcoming it when it occurs.

References

1. Morris, A. G. Gangrene of middle turbinate, sequestration of nasal septum, mucocele of frontal sinuses in case of diabetes. *New York State J. Med.* **24**:987-989, 1924.
2. Connell, E. S. Diabetic gangrene in nose. *J. Missouri M. A.* **21**: 277, 1924.
3. Goldberg, S. A. Gangrene and infection of ear, nose, and throat complicating diabetes mellitus: review of clinical manifestations with surgical considerations and report of case. *Arch. Otolaryng.* **32**:16-31, 1940.
4. Speidel, F. G. Diabetic gangrene of nasal septum and diabetic coma in woman 66 years old. *Kentucky M. J.* **42**:184, 1944.
5. Bowers, C. H. Gangrene in nose complicating diabetes. *J. A. M. A.* **82**:1325-1328, 1924.
6. Bulger, H. A. Gangrene of orbit and nares in diabetes mellitus. *J. Missouri M. A.* **26**:304, 1929.
7. Wood, T. B. Spontaneous amputation of nose due to diabetic gangrene with case report. *Ann. Otol. Rhin. & Laryng.* **46**:1112-1117, 1937.
8. Ardeshir, K. Case of gangrene of nose due to diabetes mellitus. *Lancet* **1**:1256, 1926.
9. Sturgis, R. Case of slough of lip in diabetic patient. *Boston M. & S. J.* **124**:261, 1891.
10. Riven, S. S. Dermatitis gangrenosa: complication of diabetes mellitus. *Am. J. M. Sc.* **189**:550-554, 1935.
11. Millett, J. Diabetic gangrene of face. *J. A. M. A.* **112**:1143-1145, 1939.
12. Brooks, G. P. Diabetic gangrene of face. *Brit. M. J.* **2**:539, 1929.
13. Brier, A. J. Diabetic gangrene of face and ear complicated by fifth and seventh nerve involvement. *J. A. M. A.* **103**:1704, 1934.
14. Decker, H. R. Pulmonary suppuration complicating diabetes mellitus. *Pennsylvania M. J.* **45**:596-600, 1942.
15. Elkins, C. W. W. Occurrence of diabetic gangrene in unusual location. *J. A. M. A.* **102**:2182, 1934.
16. Townsend, T. M., and Flagg, W. M. Gangrene of glans penis and urethra in diabetic. *J. Urol.* **40**:464-466, 1938.
17. Meleney, F. L. Hemolytic streptococcus gangrene. *Arch. Surg.* **9**: 317-364, 1924.
18. Buerger, L. Pathology and diagnosis of so-called diabetic gangrene. *Arch. Diag.* **8**:101-118, 1915.

MEDICAL PROGRESS

ENDOSCOPY*

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BOSTON

ALTHOUGH endoscopy may seem to be a narrow specialty, many of the most interesting diagnostic problems in the hospital eventually come to some form of endoscopic examination. As will be seen in the following review, these include many pulmonary problems that may need bronchoscopic study, gastrointestinal problems, which often require a direct inspection by esophagoscopy or gastroscopy, and various abdominal conditions, such as hepatomegaly, unexplained ascites and abdominal or pelvic masses, which may be satisfactorily studied by peritoneoscopy.

BRONCHOSCOPY

Congenital Anomalies

Ferguson and Neuhauser[1] report 5 cases of agenesis of the lung diagnosed during life by bronchoscopy, followed by iodized oil roentgenograms of the tracheobronchial tree. These cases illustrate the fact that this deformity is not incompatible with a normal existence, since 4 of the patients are living normal lives and are not handicapped by their defect.

Gross and Lewis[2] report the case of a four-year-old child who had a large opening in the anterior mediastinum, a free interpleural communication and an anomaly of the right upper-lobe bronchus. The bronchus was not more than 4 or 5 mm. in diameter. When freed adequately from overlying tissue so that it could be palpated, it was found to be soft and apparently devoid of cartilage in the exposed section. This deficiency allowed the airway to collapse in such a manner that air entered the upper lobe and became entrapped therein. Marked emphysema of the right upper lobe allowed it to protrude through the mediastinal opening and invade the left pleural cavity. The patient had intermittent attacks of severe respiratory distress, dyspnea and cyanosis, which were completely relieved by simultaneous closure of the anterior mediastinal defect and removal of the anomalous right upper lobe. This is apparently the first recorded case of surgical repair of an anterior mediastinal defect. In retrospect, one wonders whether this patient might not have been cured by right upper lobectomy alone. Although this possibility is freely admitted, it seemed to the authors at the time of operation that limitation of the surgical correction to lobectomy might be followed by subsequent distention of the left lung so that it would project through the free space in front of the heart. In order to prevent any such shift, it was believed that obliteration of the anterior mediastinal space was necessary to ensure against any recurrence of respiratory difficulties.

Gross[3] has reported a case of tracheal obstruction from a vascular ring relieved surgically. The case was that of an infant who was proved to have tracheal compression from a vascular ring within the mediastinum. The obstruction was particularly troublesome because of repeated attacks of superimposed tracheitis, for which the patient was hospitalized on four different occasions. Roentgenologic studies showed evidence of a vascular ring, and at operation the vessels were suitably divided to allow sufficient room for the trachea. The patient tolerated this surgical procedure extremely well and had marked alleviation of symptoms. The detection of a vascular ring is apparently not difficult. Since in the vast majority of these patients some portion of the ring passes behind the esophagus, fluoroscopic observation after a swallow of barium should show indentation of the posterior wall of the esophagus. If such esophageal deformity is found, the trachea can be studied by the introduction of lipiodol and by appropriate film studies in the anteroposterior and lateral views to detect any constriction of the trachea that may exist. Vascular rings do not always give rise to important clinical symptoms, but when the compression of the trachea is great enough to give rise to respiratory distress, surgical division of some portion of the ring should offer an excellent chance for relief of symptoms.

Bronchiectasis

Stookey, Lockwood, Mantz and Buckingham[4] studied penicillin therapy in bronchiectasis. The bacteriologic findings demonstrated that little aid resulted from the use of sulfonamide drugs. Staphylococci were the most consistent and persistent of the pathogens. The most frequent combination was one form of the staphylococcus with *Streptococcus viridans*. Twenty-one patients received an average of 1,000,000 units of penicillin by intramuscular and intravenous injection in eight to ten days. The volume of sputum was not influenced,

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but from a clinical standpoint cases showed evidence of improvement. Chronic bronchitis associated with periods of activity and remission gave the best hope of therapeutic response. The true bronchiectatic patient showed little or no response to penicillin. I believe, however, that in inoperable cases of bronchiectasis, penicillin inhalations combined with postural drainage and bronchoscopic aspiration offer the best hope of palliative relief.

Thomas, Van Ordstrand and Tomlinson[5] studied 75 cases of bronchiectasis treated by sulfonamides or allergic management or both. In 57 cases, lipiodol bronchography and bronchoscopy established the diagnosis. Twenty-three of these patients showed definite improvement, with a reduction of cough and expectoration while under treatment. In 31 cases, combined allergy and sulfonamide therapy was used. Twenty-six patients showed 25 to 100 per cent improvement in cough and expectoration.

In a symposium on bronchiectasis by members of the Mayo Clinic, Hinshaw[6] calls attention to the fact that bronchiectasis should not be discussed without mention of the many pitfalls in diagnosis. Obstructive lesions, such as bronchiogenic carcinoma, bronchial adenoma, foreign bodies and inflammatory stricture of a bronchus, should also be emphasized. Furthermore, tuberculosis may occur in any portion of the lung, and when it is present in a lower lobe it may resemble bronchiectasis.

Olsen[7] believes that foreign bodies, bronchial tumors, broncholiths, bronchial strictures and bronchial compression must be ruled out by bronchoscopic examination. It is his opinion that bronchoscopy should be performed in the majority of cases of suspected bronchiectasis. Furthermore, the bronchoscopist can frequently play an important part in the prevention of bronchiectasis. The timely removal of an aspirated foreign body almost invariably prevents the development of pulmonary suppuration. Bronchial obstruction due to neoplasms or broncholiths may be relieved by bronchoscopic means, and in many cases permanent damage to the bronchi may be avoided. Pulmonary atelectasis not infrequently occurs after surgical procedures when thick, tenacious secretions become impacted in the bronchi. Bronchoscopic aspiration of these secretions should be carried out early if bronchial disease and pulmonary complications are to be prevented. When a pneumonic process fails to resolve, bronchial complications should be suspected.

Clerf[8] thinks that bronchoscopy is of value in bronchiectasis only as a diagnostic aid and as a palliative measure preparatory to carrying out surgical treatment. In cases of obstructive bronchiectasis a diagnostic bronchoscopy is absolutely indicated before surgical intervention, since there may be present a foreign body, stricture of the bronchus or benign neoplasm, any of which may seriously complicate the surgical result. All cases of unilateral bronchiectasis should be considered as surgical problems, since no cure can be obtained by bronchoscopy alone. Its use would, therefore, deprive of a cure a patient suitable for surgical treatment.

Foreign Bodies

Hammond[9] reports an emergency cervical mediastinotomy in a case of massive mediastinal and subcutaneous emphysema secondary to removal of a foreign body from the bronchus. The foreign body was a piece of apple, found in the orifice of the left main bronchus. A piece of it was removed with forceps, following which the remaining portion was suddenly and forcibly expelled through the bronchoscope. Twenty minutes later the author was urgently called to the pediatric floor to see the patient. Swelling of the tissues of the neck and the upper chest was noted, following which respirations became labored and the abdomen began to swell. The picture was extraordinary. The whole body was emphysematous, particularly the abdomen, which had the appearance of a balloon that was rapidly becoming overinflated with each respiration. The eyelids were bulging, and the scrotum was as large as two adult fists. Crepitation was noted over the entire body, extending to the fingers and toes. Immediate cervical mediastinotomy was decided upon. A midline incision was made from the thyroid notch to the sternum. There was a sudden gush of air from the subcutaneous tissues. Abdominal tension was relieved by multiple needle punctures under the skin. Within a few minutes, respirations appeared normal, and the wound was lightly packed with vaseline iodoform gauze and the patient returned to bed. Hammond concludes as follows:

> A check-valve obstruction of the bronchus by a vegetal foreign body is reported in a child. The increased pulmonary pressure secondary to a foreign body in the bronchus was aggravated by the straining during bronchoscopy. A rupture of the alveoli followed, with the escape of air along the blood vessels to the mediastinum, following which there was generalized extension of air over the whole body by way of the blood vessel sheaths. The rapid and continuous passage of air into the body tissues led to marked ballooning and extreme cyanosis. Fatal termination was prevented by an emergency cervical mediastinotomy.

Adenoma

Clerf[8] calls attention to the fact that in the earlier cases of adenoma it was not known that many of these tumors presented an extrabronchial as well as an endobronchial portion. Bronchoscopic methods of therapy were therefore instituted, and remarkably good results were secured in a number of cases. If one can determine by bronchoscopy and tomographic studies that the tumor is endobronchial, it may be successfully treated by diathermy. If there is an extrabronchial portion, however, surgical extirpation will ultimately become necessary. Clerf has found it necessary to have a number of his earlier cases submit to surgical treatment. Although there are observers who believe that this is

a malignant tumor, few cases of implants either in the lung or in other tissues have been recorded.

Jackson, Konzelmann and Norris[10] have studied the clinical features of 20 cases of so-called "adenoma of the bronchus." They believe that infiltration of the bronchial wall is possible, but that it is sufficiently infrequent and limited when it does occur so that endobronchial removal is justified when it can be done, it being admitted that complete removal by this means is often not possible and that obviously incompletely removed tumors will recur. That these tumors may undergo malignant change must be admitted. The experience of the Jackson Clinic indicates that malignant change is infrequent. These authors do not believe that adenomas have any inherent tendency to metastasize or become malignant in any other way. None of their patients have shown such a course, although a number have been under observation for ten years or longer. The possibility of extrabronchial growth of adenomas, producing a so-called "collar-button" lesion with the larger part outside the bronchus, is recognized but is thought by many to have been overemphasized. Bronchoscopic treatment by forceps removal, electrocoagulation and aspiration is indicated as the first step in all cases; it is curative in some and palliative in others. In cases in which there is atelectasis or bronchiectasis, a preoperative course of bronchoscopic treatment is indicated, even if lung resection has been definitely decided on or is to be considered at a later date. Lobectomy or pneumonectomy is indicated when bronchoscopic cure of the bronchial lesion seems impossible, or when prolonged bronchial obstruction has resulted in serious permanent damage to the distal portion of the lung.

Graham and Womack[11] have also discussed so-called "bronchial adenoma," stating that the chief clinical problem that these tumors present concerns the question of whether they are to be regarded as either actually or potentially invasive in nature or should be considered purely benign in type. It is difficult to understand how there could be any controversy on the point at this time. If one accepts as criteria of malignancy invasion of adjacent tissues, involvement of regional lymph nodes and metastasis to distant organs, then in the light of a considerable amount of published experience one cannot deny that there have been authentic cases in which these tumors have become malignant, for many cases have been recorded in which these three criteria mentioned have been present. In view of the well established malignant potentialities of bronchial adenoma, the principles of treatment become clear. It seems to Graham and Womack that radical surgical removal is the procedure of choice. Because of the frequency with which one finds a large portion of the tumor outside the bronchus, it appears that only rarely can it be completely removed through the bronchoscope. In many cases such an attempt is particularly hazardous because of the danger of perforation of the bronchus. If the tumor is not completely removed, there will always be the danger of a later invasion by the part left behind, as in the case cited by Burrell[12] and that of Graham and Womack. An additional objection to the local removal of the tumor is the uncertainty in many cases of whether it is actually malignant at the time of operation, and if so, the extent of its spread. The piece of tissue that has been removed by bronchoscopy for biopsy may not show clear evidence of malignancy, even when the tumor has already invaded neighboring tissues or regional lymph nodes. Still another reason why bronchoscopic removal is likely to be unsatisfactory is that there is often an associated bronchiectasis, supposedly due to the bronchial obstruction produced by the tumor. Undoubtedly lobectomy sometimes proves to be an adequate operation, but it is Graham and Womack's opinion that often it is not adequate because of the location of the tumor. They therefore prefer the operation of total pneumonectomy for these cases. The removal of possibly involved regional lymph nodes can be much more satisfactorily accomplished in this way. In good-risk patients there is scarcely if any greater danger from the operation of total pneumonectomy than from lobectomy. In conclusion, these authors are in disagreement with Jackson,[10] believing that the frequent inability to determine from a biopsy specimen whether the tumor has already become malignant makes an attempt at local removal through the bronchoscope both unwise and dangerous. They claim that total pneumonectomy is the procedure of choice.

In a discussion of the above paper, Alexander states that he and Dr. Haight and their pathologist, Dr. Carl Weller, all agree that so-called "adenoma" is a Grade 1 carcinoma.[13] They believe that the risks of hemorrhage, of recurrence and particularly of transition to a more active type of malignancy than Grade 1 carcinoma, or from the fetal stage to a true carcinoma stage, together with the great ultimate risk to life of suppuration of the lung and pleura, far outweigh the risks of expertly performed lobectomy or pneumonectomy.

In reply to Alexander's remarks, Jackson[13] stated that in his cases he had not had any cases of "frightful" hemorrhage from an adenoma. He believes that the way to minimize the risk from hemorrhage is not to try to do too much at one time. Biopsy is enough for the first time, then electrocoagulation, subsequently alternating forceps removal with electrocoagulation at appropriate intervals, removing the obstructive lesion in a series of bronchoscopies rather than trying to effect a cure in one treatment.

Holinger[13] states that in his experience the question of hemorrhage is one that influences the choice of therapy. If a tumor has a tendency to bleed profusely when efforts are made bronchoscopically to

free the affected bronchus, bronchoscopic removal is discontinued and surgical resection is advised. He believes that cases with a marked tendency toward bleeding are definitely not bronchoscopic problems.

In a continuation of this discussion, Graham[13] states that bronchial adenomas are potentially malignant. In his clinic he knows of more than 10 cases in which there have been regional or distant metastases from tumors that began as adenomas with a long history.

Tyson and Milliken[14] think that recently there has been a swing toward the viewpoint that adenoma is usually benign but may become malignant. Because of irreparable lung damage beyond the tumor and the possibility of extrabronchial extension of the tumor, they concluded that in the case reported a pneumonectomy was necessary. Examination of the surgical specimen showed that the adenoma had protruded through the posterior surface of the bronchus in a collar-button manner, the extrinsic portion being about a fourth as large as the portion within the lumen. The middle and lower lobes were completely obstructed and their bronchi were filled with mucopurulent material. The patient's only symptom four years after the operation is some shortness of breath and wheezing if she walks rapidly up a steep hill. She is able to carry on her housework and her duties as a telephone operator without respiratory embarrassment.

Chamberlain and Gordon[15] also favor pulmonary resection for bronchial adenoma. Although these tumors were first treated by endobronchial removal, these authors believe that pulmonary resection is preferable for the following reasons. It offers a definitive cure; the hazards associated with the damaged lung distal to the tumor are avoided; and some of these tumors are potentially malignant and occasionally metastasize. Endobronchial removal is indicated in four groups of cases — those that are not reasonable surgical risks: those that involve the trachea; those with abscess distal to the tumor, which are best prepared for subsequent resection through improvement in the bronchial drainage; and the rare cases in which the tumor is entirely within the bronchus, easily accessible and attached by a long, slender pedicle. These authors report 10 cases all having the same fundamental features characteristic of bronchial adenoma, the extrabronchial portion in each case being larger than the endobronchial element. Pulmonary resection completely removes the tumor and the irreparably damaged lung distal to the obstruction. At operation mediastinal nodes should also be removed, since they are occasionally involved. Endobronchial therapy, although favorably reported on, lacks the advantage mentioned and has some disadvantages. It requires repeated manipulations, since local recurrences are frequent, and the risk of severe hemorrhage is always a consideration. Cicatrization may occur following repeated bronchoscopic treatments, with or without the use of radon. Such scarring and stenosis interfere with the cleansing mechanism of the bronchus — ciliary action and bronchial peristalsis — and predispose to pulmonary suppuration. The principal therapeutic objective is maintaining a patent airway if cicatricial stenosis is substituted for an obstructing tumor. Even in the absence of scarring and local recurrence stenosis may occur.

Clerf and Bucher[16] have noted in cases treated by bronchoscopy that after years of freedom from symptoms and no recurrence of the growth endobronchially, there is progressive narrowing of the bronchial lumen by either an intramural or an extrabronchial growth. It is of interest that the cause of death in these cases is usually due to pleural and pulmonary suppuration, secondary to the bronchial obstruction, and occasionally to hemoptyses following bronchoscopic manipulation; yet there is no record of a death due to metastases.

Harrill[17] reports a case of adenoma of the trachea, the most prominent clinical feature of which was tracheal obstruction. Adenoma arising from the upper part of the trachea is rare. A tracheotomy was done, and the mass was later removed by forceps through a tracheoscope.

Cylindroma

McDonald, Moersch and Tinney[18] have reported 6 cases of cylindromas of the bronchus. Histologically, cylindroma presents a different appearance from that of adenoma of the bronchus and appears to be more allied to mixed tumors. The clinical course is remarkably similar to that of adenoma. The bronchoscopic appearance of the tumor is also similar to that of adenoma. Bronchiectasis and lung abscess are frequent sequelae to the long-standing obstruction produced by the tumor.

Carcinoma

Overholt and Wilson[19] have recently discussed silent and masquerading intrathoracic lesions. They believe that the figures regarding the bronchoscopic diagnosis of bronchiogenic carcinoma are misleading. They state that the medical literature abounds with statistics indicating that 70 to 75 per cent of all bronchiogenic carcinomas originate in the major bronchi and are thus visible through the bronchoscope and accessible for biopsy. They believe that these figures are false when applied to early carcinoma of the bronchus. If bronchoscopy is performed early, it is negative in 40 per cent of the cases because the site of origin is beyond bronchoscopic view. Bronchoscopy is, therefore, an unreliable guide when the results are negative, since it does not in any way exclude the presence of the tumor immediately beyond the vision of the bronchoscopist. They believe that in the diagnosis of early cancer bronchoscopy is about 50 per cent inefficient; furthermore, a negative bronchogram in no way

rules out tumor. Exploratory thoracotomy, they conclude, is a procedure that is used too little and too late. As regards safety and accuracy it is on a par with abdominal exploration.

Clerf[20] believes that, since primary carcinoma frequently occurs in large bronchi that are accessible to bronchoscopic investigation, much aid has been given to the clinician by the bronchologist in its diagnosis. There is no question in diagnosis if the classic infiltrating, ulcerated lesion is observed and a biopsy specimen can be secured. Lesions occurring in an upper lobe "around the corner" or in subdivisions of the lower lobes or middle lobe present difficulties that must be promptly surmounted if any benefit is to be gained by establishing a positive early diagnosis. Although the orifices of the upper lobe can be satisfactorily inspected by a telescopic obturator introduced through the bronchoscope, too often the lesion is beyond this point. In these cases it is desirable to use a flexible, tipped aspirating tube attached to a collector so that secretions can be secured from "around the corner" and examined for neoplastic cells. Careful attention to this will be rewarded by a fairly large number of positive findings. A similar procedure can be instituted for subdivisions of the bronchi of the middle and the lower lobe. The bronchologist also should observe whether there is narrowing, deformation, fixation or rigidity of a bronchus owing to neoplastic infiltration. In the absence of biopsy material these findings are of great diagnostic significance. Information concerning the mobility of the carina and the angle of division of the trachea is of importance to the thoracic surgeon.

Miranda and Gonnella[21] report a case of primary bronchial carcinoma with early cutaneous metastasis. This is a rare site for metastatic lesions from bronchial carcinoma. The patient was a man of thirty-seven who one month after recovery from pneumonia developed a chronic bronchitis with multiple cutaneous nodules over the chest wall. A diagnosis of bronchial cancer was confirmed by bronchoscopy and by biopsy of the metastatic nodules.

In a paper on the difficulties encountered in the differential diagnosis of bronchiogenic carcinoma, Bloch, Adams, Thorton and Bryant[22] note the increased interest in carcinoma of the lung, which has led to much improvement in the diagnosis of pulmonary tumors. With an ever better roentgen technic and by bronchoscopy, their differentiation from other involvements of the lungs seems to have become comparatively easy, and a diminishing number of patients with endobronchial cancer die because of an erroneous diagnosis. Routine chest fluoroscopy in 15,000 patients showed that 91 (0.6 per cent) had intrathoracic neoplasms. X-ray examination, which is indispensable for the discovery of a lesion, in no case offers a reliable differential diagnosis. Although the bronchoscope is also indispensable, bronchoscopy also results in failure to make a positive diagnosis when the tumor is inaccessible to the bronchoscope. Bronchoscopy in early peripheral tumors, which according to Jaffe[23] constitute 13 per cent of the total incidence, is always negative. In the absence of bronchoscopic findings, therefore, surgical exploration alone can lead to an acceptable diagnosis. It should be undertaken even in early cases when there seems to be a strong enough possibility of neoplasm.

In an analysis of 175 proved cases of bronchiogenic carcinoma, Holinger, Hara and Hirsch[24] have called attention to the United States Government's vital statistics on carcinoma in children and young adults. In 1940, 1 death occurred in an infant under one year of age, 3 in those under two years, 2 in those under four years, 8 in children between five and nine years, 18 in those between ten and eighteen, 22 in those between fifteen and nineteen, 44 in persons between twenty and twenty-four and 38 in those between twenty-five and twenty-nine. The disease is much more frequent on the right side than on the left, the ratio being 11:6. Bronchoscopic examination should be made in patients with obscure pulmonary disease as suggested by the history, symptomatology and x-ray findings. Such symptoms as persistent cough, wheeze, unexplained hemoptysis and recurring or so-called "unresolved" pneumonia are all specific indications for bronchoscopy. All too frequently, however, such indications are ignored and this examination is postponed or not considered. The presumptive diagnosis of atypical pneumonia and the prolonged ineffective use of chemotherapy in an effort to clear a supposed pneumonia have been responsible for many delays in bronchoscopic examination. In this series, six months or longer elapsed between the initial symptoms and bronchoscopy in 86 (50 per cent) of the patients. In 14 (8 per cent) more than one year elapsed. Among the latter group were 3 who had had a cough for more than ten years and could not accurately tell when their illness began. The treatment of bronchiogenic carcinoma is primarily surgical. Bronchoscopic treatment of bronchiogenic carcinoma is mentioned not as opposed to surgery but as a means of therapy in patients otherwise inoperable. Although the results of endobronchial therapy by implantation of radon seeds or radium directly into the tumor have usually been palliative, clinical cures by the use of this method together with surgical diathermy have been reported.

Pillsbury and Wassersug[25] have studied 12 proved cases of bronchiogenic carcinoma that were admitted to a tuberculosis hospital. Patients with bronchiogenic carcinoma are occasionally admitted to a sanatorium, either for observation for tuberculosis or because a definite diagnosis of tuberculosis has already been made. Since the clinical findings may be misleading, reliance must be placed on other diagnostic aids, such as x-ray examination, bronchoscopy and exploratory thoracotomy. Bronchio-

genic carcinoma must be promptly differentiated from tuberculosis, since time and rest never cure a malignant growth. Waiting six weeks or longer for results of animal inoculation or tests of cultures of sputum may rob the patient of his chance of surgical cure. If on the basis of physical and x-ray examination the disease cannot be differentiated from pulmonary tuberculosis and a few specimens of sputum are negative, bronchoscopy should be performed without further delay. Inspection of the bronchi, if the patient's general condition admits it, yields valuable information that may determine not only the diagnosis but also how the case is to be managed. This is as true in pulmonary tuberculosis as it is in bronchiogenic carcinoma, since the presence or absence of endobronchial tuberculosis may alter the plans for collapse therapy. Hence, in either disease much may be gained by prompt bronchoscopic examination.

Griess, McDonald and Clagett,[26] in a study of the proximal extension of carcinoma of the lung in the bronchial wall, state that it is important for the surgeon to know what type of tumor he is dealing with in order to appreciate how close to the macroscopic lesion to make the operative incision. In an extremely limited number of cases it appears that on the average an adenocarcinoma extends much farther than does a squamous-cell epithelioma. With the skill of the modern bronchoscopist, biopsy can be done previous to the operation, and the surgeon, knowing what kind of lesion he is dealing with, can decide where to sever the bronchus. There are, of course, certain anatomic limits, and these probably accounted for the incision's passing through the carcinoma in some of the cases in this series. When dealing with adenocarcinomas the surgeon should, if anatomically possible, sever the bronchus more than 2 cm. proximal to the gross limits of the lesion. If the tumor is a squamous-cell epithelioma, a safe distance to sever the bronchus is at least 1.5 cm.

Tinney, Moersch and McDonald[27] have reviewed 27 cases of neoplasm of the trachea seen at the Mayo Clinic since 1921. The lower third of the trachea is the region likeliest to be involved. Chills and fever, which frequently accompany bronchiogenic carcinoma, are less apt to occur in cases of tracheal tumor. Although routine roentgenographic studies may be of little importance in establishing the diagnosis, tomographic studies are often of considerable value. Roentgenograms taken after instillation of iodized oil into the trachea help fairly frequently to show the outlines of the lesion and often lead to the correct diagnosis. Sometimes the tumor may be seen on direct laryngoscopy. In most cases of carcinoma of the trachea, however, the diagnosis is dependent on bronchoscopic examination. The tumors in these 27 cases were divided into four distinct groups — squamous-cell carcinoma, 11 cases; cylindroma, 8 cases; adenocarcinoma, 6 cases; and hemangioendothelioma, 2 cases. Carcinoma of the trachea offers an extremely difficult therapeutic problem, and no one form of treatment has been found satisfactory in all types of cases. Carcinoma situated in the upper portion of the trachea is best handled by means of tracheal fissure and destruction of the tumor by electrocoagulation, as advocated by Figi.[28] Carcinoma situated in the lower end of the trachea is best treated by electrocoagulation of the tumor through the bronchoscope. In a case of the series at the Massachusetts General Hospital in which adenocarcinoma of the trachea was extensive and could not be treated adequately by means of surgical diathermy the use of roentgen-ray therapy alone was followed by marked benefit. Although the life expectancy of most patients is between six months and one year, there are some notable exceptions. This is particularly true of tumors of the cylindroma group. One of the patients with this type of tumor died ten years after the diagnosis was made, apparently of an entirely unrelated disease. The other 7 were living and well when last heard from.

Hamartoma

McDonald, Harrington and Clagett[29] state that hamartoma of the lung has often been called chondroma. It is supposed to be the result of abnormal development of the bronchial anlage; — hence the name "hamartoma" (to err). The term was coined in 1904 by Albrecht, who stated:

> Hamartomata are tumorlike malformations in which occurs only an abnormal mixing of the normal components of the organ. The abnormality may take the form of a change in quantity, arrangement or degree of differentiation, or may comprise all three. The deduction to be drawn from histologic examination of these formations is that they have originated in an abnormal mixing of the elements or from disturbance of their development.

McDonald et al. have confined the use of the term "hamartoma of the lung" to a specific type of tumor that has a characteristic morphologic appearance; this is a solid tumor of the bronchus consisting of benign mesodermal and benign epithelial elements. Their paper is based on a study of 23 patients with hamartoma of the lung. Since the tumor is usually situated in the periphery of a pulmonary lobe, bronchoscopic examination is not of much value, but it should be done to rule out other pulmonary lesions. In 3 cases, the tumor was removed surgically; in the remaining 20, it was discovered at autopsy. These 20 cases were part of a consecutive series of 7972 cases in which autopsy was performed; the incidence of hamartoma of the lung in this series was 0.25 per cent. They conclude that this tumor occurs more frequently than has been recognized. It is strictly benign and only occasionally causes symptoms. In most cases the diagnosis has to be made by roentgenographic examination. A hamartoma should be suspected in every case of a solitary lesion of the lung. It frequently cannot be distinguished from other lesions of the lung until a

specimen of the tumor is examined microscopically. Treatment consists of excision of the tumor. One should try to conserve as much pulmonary tissue as possible.

Tuberculosis

Clerf[30] believes that credit must be given to bronchoscopy for the discovery that certain signs and symptoms in tuberculous patients and certain complications following the surgical treatment of tuberculosis are the result of tuberculous involvement of the larger bronchi by infiltrative, ulcerogranulomatous or cicatricial lesions. It is in this group that bronchoscopy plays a definite part in diagnosis as well as in treatment. Inspection of the tracheobronchial tree is usually adequate to determine the presence of infiltrative and ulcerogranulomatous lesions, and biopsy is therefore advised against unless there is considerable evidence to support the belief that carcinoma is present. It is important to discover the presence of obstructive lesions in a bronchus so that the clinician or surgeon may take this into account when contemplating some form of collapse therapy.

Wilson[30] has attempted to correlate the clinical and pathological findings in tracheobronchial tuberculosis. Endobronchial tuberculosis has been found in 10 to 15 per cent of patients at the time of sanatorium admission. The author advises that no attempt be made to dilate fibrotic stenosis; instead, he suggests thoracoplasty or pneumonectomy. He opposes biopsy because of the possibility of initiating ulceration. He advises treatment with silver nitrate every two weeks until healing ensues, following which the intervals between applications should be gradually lengthened. If no response is obtained over a reasonable time, pulmonary resection is advised.

Chamberlain,[31] in a discussion of lobectomy versus thoracoplasty in the treatment of tuberculosis, repeatedly states that endobronchial tuberculosis is present in all cases of tuberculosis with cavitation. Although clinically physicians have been aware of endobronchial tuberculosis only in the last ten years, it has always been present, though it may have been beneath the mucosa or just beyond the view of the bronchoscopist. The significance of this complication is directly proportional to the kind of endobronchial lesion, the size of the bronchus involved and the degree of obstruction. Obviously, a small submucous tubercle is not so serious as an ulcerative lesion that circumscribes and almost completely obstructs a large bronchus. An ulcerative endobronchial lesion of moderate or extreme severity implies severe damage distal to it in the form of obstructive emphysema, suppuration, atelectasis or tension cavities. A definitive form of therapy is therefore indicated if one or more of these complications exist. Thoracoplasty had met with considerable success before physicians were aware of the presence of endobronchial tuberculosis, and they now intentionally do thoracoplasties in cases with certain types of lesions in the major bronchi (visible at bronchoscopy), with good results as reported by Alexander, Tuttle, Chamberlain, and Gordon.[32] It must also be kept in mind that in every case of tuberculosis there are both obstructive (endobronchial disease) and overdistention types of emphysema, which are directly proportional to the amount and duration of the tuberculosis. Endobronchial tuberculosis is present in all cases with cavitation, and its significance is essentially dependent on the degree of bronchial obstruction, which may cause obstructive emphysema, suppuration, atelectasis and tension cavities. Thoracoplasty is successful in 75 per cent of the cases in which the diseased bronchus is visible by bronchoscopy.

In a discussion of pulmonary resection in the treatment of tuberculosis, Overholt and Wilson[33] point out that bronchoscopy has revealed the presence of bronchial tuberculosis in many patients. This has helped to avoid many of the mistakes made in the earlier selection of cases and to plan the proper operation and the extent of resection. Tuberculous bronchitis, either active or inactive, is not itself a contraindication to resection even if it has to be traversed during the procedure. On the contrary, this complication is often an indication for resection.

Stone,[34] in a discussion of the clinical aspects of endobronchial tuberculosis, states that the lung specialist can never consider himself adequately trained until he has mastered the art of bronchoscopy. Furthermore, bronchoscopy will never render its maximum service to medicine until it is embraced by the man to whom it rightfully belongs — the specialist in chest diseases. The incidence of endobronchial tuberculosis obviously varies with the zeal as well as with the skill of the operator. The diagnosis of endobronchial tuberculosis can be definitely made only when it can be visualized by the bronchoscopist. The chief symptoms in this group are a localized wheeze and loud auscultatory rhonchi. Next to wheezing and rhonchi is the completely collapsed lung or the so-called "opaque" unexpandable lung.

Postoperative Use of the Bronchoscope

Clerf[30] points out that an extremely simple method of removing excessive secretions in the tracheobronchial tree after an operation consists of the employment of a catheter introduced into the trachea and attached to a mechanical apparatus. Patients who cannot be relieved by these simple methods should be aspirated by bronchoscopy.

Aronovitch[35] calls attention to the formation of a mucous plug following operation, with the familiar picture of fever, shallow respirations, cyanosis and chest pain. Sometimes exceedingly simple procedures such as a slap on the back, directing the patient to cough hard or placing him in the proper

position dislodge the plug. If after twenty-four hours these measures fail when used in combination with adrenalin or ephedrine, aspiration should be performed.

Lundy and his associates[36] in a report on anesthesiology have again emphasized the importance of bronchoscopic aspiration at the end of operation. Such an operation is generally acknowledged to be valuable and has proved to be so in their hands, especially in intrapulmonary operations.

In the surgical treatment of bronchiectasis, Clagett[37] uses bronchoscopy immediately after operation to clear the bronchial tree.

Lung Abscess

According to Clerf,[20] in the earlier days of bronchoscopy before much progress had been made in the successful treatment of pulmonary abscess by thoracic surgery, it was not unusual to practice bronchoscopic aspiration in these cases. The fundamental principle was a sound one — namely, that the abscess would undergo resolution if adequate drainage of pus could be established and maintained. In a certain number of cases of acute pulmonary abscess one can obtain satisfactory results if drainage can be improved by bronchoscopic aspiration with curved, flexible, tipped aspirating tubes and the employment of shrinking solutions. It is believed inadvisable, however, to continue bronchoscopic treatment for more than two or three weeks unless continuous improvement is observed. If the temperature does not promptly return to normal after several aspirations and definite improvement is not shown by roentgen-ray examination, bronchoscopic treatment should be discontinued.

No report can be given on the newer drugs, notably sulfonamides and penicillin employed bronchoscopically. It is believed that these exert little effect if introduced into the abscess cavity through the bronchoscope. In chronic abscess and in cases in which there is a question of new growth complicated by abscess, a diagnostic bronchoscopy is indicated. Cases of endobronchial foreign body, either exogenous or endogenous, complicated by pulmonary abscess have been recorded, and a number of cases of unsuspected carcinoma of the bronchus have been treated surgically as cases of pulmonary abscess, with unfavorable results.

Smyth and Billingslea,[38] in a review of the literature, have found reference to 31 cases of lung abscess treated with penicillin. Thirteen have shown complete recovery, 8 have shown satisfactory improvement, and in 10 cases there was either no change or death occurred. In a study of 4 of their own cases, these authors state that the long-continued use of penicillin has resulted in the control of the surrounding pneumonitis in all 4 cases and has permitted the healing of the abscess cavities in 3 of them. They are of the opinion that if lung abscesses are recognized early and are vigorously treated by long-continued penicillin administration, there will be an appreciable reduction in the morbidity and mortality from this disease.

Valle[39] has analyzed 244 cases of lung abscess. The differentiation of simple lung abscess and carcinoma is difficult because there is often a combination of the two resulting from an infection of the carcinoma. The x-ray picture of bronchiogenic carcinoma often shows atelectasis of one lobe and a poorly outlined shadow. Some cases of carcinoma develop pleural fluid in which carcinoma cells can be detected. The author believes that the best means of differentiating the two is bronchoscopy, which in bronchiogenic carcinoma generally reveals the growth to be blocking the bronchus, from which a biopsy can be taken. Sometimes the bronchus can be seen to be compressed from without. In a few cases the tumor is out of reach of the bronchoscope and an accurate diagnosis cannot be made until an exploratory thoracotomy has been performed. As regards etiology and pathogenesis, Valle found that lung abscesses developed in 41 cases after tonsillectomy under anesthesia and in 27 after abdominal operation under general anesthesia. In this connection he states that Myerson subjected to bronchoscopy a number of patients who had had tonsillectomies performed under general and local anesthesia and found blood and mucus in the lower bronchi in 90 per cent of the cases with general anesthesia, but in a much lower percentage among those having local anesthesia and the cough reflex present. Valle and his associates consider bronchoscopy one of the most important features in the diagnosis and treatment of lung abscess. Of 80 patients treated by bronchoscopy alone, 47 were improved. As a diagnostic procedure it is extremely useful in localization of the abscess by revealing which bronchus is the source of pus. As a part of the treatment bronchoscopy is much used. Sometimes the draining bronchus becomes plugged, and by introducing the flexible suction tip into the bronchus the mucous plug is removed and drainage promoted. Patients who are confined to bed can often be so greatly improved by several bronchoscopic aspirations that the later surgical drainage becomes less hazardous. Valle considers bronchoscopy imperative whenever aspiration of a foreign body into the bronchial tree is suspected.

Sweet[40] has analyzed the cases of lung abscess from 1938 to 1942 at the Massachusetts General Hospital. He notes the significant fact that the total duration of the disease in many of the spontaneous-cure group was of surprising length. Although 9 patients recovered in three months or less, the disease lasted for three to six months in 8 cases and from six to twelve months in 6. Two patients recovered after the expiration of one year. The use of sulfonamide chemotherapy produced no material change in the results in this series. Although lung abscess continues to be a serious disease, there

has occurred over the last ten or more years an encouraging increase in the number of cures and a gratifying reduction in the mortality rate.

Hemoptysis

Adams and Ficarra[41] note that "hemoptysis" is a term specifically applied to bronchopulmonary hemorrhage. Before bleeding emanating from the nose or mouth can be definitely called hemoptysis, all forms of pseudohemoptysis must be eliminated. The types of bleeding most frequently confused with hemoptysis are hematemesis and epistaxis. Inspection of the nasal and oral pharynx will exclude epistaxis and bleeding from the pharynx, the back of the nose, the tonsils, teeth, gums, tongue and mucous membrane of the buccal cavity. The differential diagnosis between hemorrhage from the alimentary canal and bronchopulmonary hemorrhage is often difficult. The majority of causes for hemoptysis can be classified in the following groups: tuberculosis of the lung and bronchi, bronchiectasis, abscess of the lung, lobar pneumonia, infarction of the lung, carcinoma of the lung, traumatic lesions of the chest and congestive heart failure. Less frequent etiologic agents are chronic bronchitis, diseases of the larynx, adenoma of the bronchus, gangrene of the lung and mediastinal tumors. The diagnosis can be made from the history and physical findings, roentgen-ray studies, bronchoscopy and laboratory data, including sputum studies. Bronchoscopy as a therapeutic measure is useful when bleeding has been so extensive as to cause bronchial obstruction or atelectasis.

Complications

Abbott and De Oliveira[42] have reported 4 cases of pneumothorax occurring in conjunction with bronchoscopy and 1 case coincident to esophagoscopy. In the cases reported no major bronchi suffered direct injury. They describe the phenomenon not as a complication of bronchoscopy but rather as an indirect hazard of the coughing paroxysm subsequent to endoscopic manipulation.

(*To be concluded*)

References

1. Ferguson, C. F., and Neuhauser, E. B. D. Congenital absence of lung (agenesis) and other anomalies of tracheobronchial tree. *Am. J. Roentgenol.* **52**:459-471, 1944.
2. Gross, R. E., and Lewis, J. E. Defect of anterior mediastinum: successful surgical repair. *Surg., Gynec. & Obst.* **80**:549-554, 1945.
3. Gross, R. E. Surgical relief for tracheal obstruction from vascular ring. *New Eng. J. Med.* **233**:586-590, 1945.
4. Stookey, P. F., Lockwood, I. H., Mantz, H. L., and Buckingham, W. W. Penicillin therapy in bronchiectasis. *South. M. J.* **38**: 98-103, 1945.
5. Thomas, J. W., Van Ordstrand, H. S., and Tomlinson, C. Treatment of bronchiectasis with chemotherapy and allergy management. *Ann. Int. Med.* **23**:405-413, 1945.
6. Hinshaw, H. C. Medical aspects of bronchiectasis. *Proc. Staff Meet., Mayo Clin.* **20**:17-20, 1945.
7. Olsen, A. M. Bronchoscopy in diagnosis and treatment of bronchiectasis. *Proc. Staff Meet., Mayo Clin.* **20**:20, 1945.
8. Clerf, L. H. Peroral endoscopy in thoracic surgery. *Clinics* **3**:1361-1368, 1945.
9. Hammond, A. E. Emergency cervical mediastinotomy in case of massive mediastinal and subcutaneous emphysema secondary to removal of foreign body from bronchus. *Ann. Otol., Rhin. & Laryng.* **53**:829-836, 1944.
10. Jackson, C. L., Konzelmann, F. W., and Norris, C. M. Bronchial adenoma. *J. Thoracic Surg.* **14**:98-105, 1945.
11. Graham, E. A., and Womack, N. A. Problem of so-called bronchial adenoma. *J. Thoracic Surg.* **14**:106-119, 1945.
12. Burrell, L. S. T. Discussion on value of bronchoscopy in diagnosis and treatment. *Proc. Roy. Soc. Med.* **31**:421, 1938.
13. Discussion of Graham and Womack.[11]
14. Tyson, M. D., and Milliken, N. T. Total pneumonectomy for benign bronchial adenoma: case report. *Am. J. Surg.* **67**:111-118, 1945.
15. Chamberlain, J. M., and Gordon, J. Bronchial adenoma treated by pulmonary resection: case reports. *J. Thoracic Surg.* **14**:114-159, 1945.
16. Clerf, L. H., and Bucher, C. J. Adenoma (mixed tumor) of bronchus: study of 35 cases. *Ann. Otol., Rhin. & Laryng.* **41**:836-850, 1942.
17. Harrill, J. A. Adenoma of trachea. *Arch. Otolaryng.* **41**:74-76, 1945.
18. McDonald, J. R., Moersch, H. J., and Tinney, W. S. Cylindroma of bronchus: report of six cases. *J. Thoracic Surg.* **14**:445-452, 1945.
19. Overholt, R. H., and Wilson, N. J. Silent and masquerading intrathoracic lesions. *New Eng. J. Med.* **234**:169-180, 1946.
20. Discussion of Clerf.[8]
21. Miranda, M., and Gerardo Gonnella, C. Carcinoma bronquial con metastasis multiples precoces intracutaneas. *Prensa méd. argent.* **32**:1099-1102, 1945.
22. Bloch, R. G., Adams, W. E., Thornton, T. F., and Bryant, E. J. Difficulties in differential diagnosis of bronchogenic carcinoma. *J. Thoracic Surg.* **14**:83-97, 1945.
23. Jaffe, R. H. Primary carcinoma of lung: review of 100 autopsies. *J. Lab. & Clin. Med.* **20**:1227-1237, 1935.
24. Holinger, P. H., Hara, H. J., and Hirsch, E. F. Bronchogenic carcinoma: analysis of 175 proved cases. *Ann. Otol., Rhin. & Laryng.* **54**:5-36, 1945.
25. Pillsbury, N. R., and Wassersug, J. D. Differentiation of bronchiogenic carcinoma and pulmonary tuberculosis. *New Eng. J. Med.* **232**:276-278, 1945.
26. Griess, D. F., McDonald, J. R., and Clagett, O. T. Proximal extension of carcinoma of lung in bronchial wall. *J. Thoracic Surg.* **14**:362-368, 1945.
27. Tinney, W. S., Moersch, H. J., and McDonald, J. R. Tumors of trachea. *Arch. Otolaryng.* **41**:284-290, 1945.
28. Figi, F. A. Primary carcinoma of trachea. *Arch. Otolaryng.* **12**: 446-456, 1930.
29. McDonald, J. R., Harrington, S. W., and Clagett, O. T. Hamartoma (often called chondroma) of lung. *J. Thoracic Surg.* **14**:128-143, 1945.
30. Wilson, N. J. Bronchoscopic observations in tuberculous tracheobronchitis — clinical and pathological correlation. *Dis. of Chest* **11**: 36-59, 1945.
31. Chamberlain, J. M. Primary upper lobectomy versus modern selective thoracoplasty in treatment of tuberculosis: physiopathologic considerations. *J. Thoracic Surg.* **14**:32-45, 1945.
32. Discussion of Chamberlain.[31]
33. Overholt, R. H., and Wilson, N. J. Pulmonary resection in treatment of tuberculosis: preliminary report. *J. Thoracic Surg.* **14**: 55-82, 1945.
34. Stone, M. J. Clinical aspects of endobronchial tuberculosis. *Dis. of Chest* **11**:60-71, 1945.
35. Aronovitch, M. Medical treatment of postoperative pulmonary atelectasis. *Canad. M. A. J.* **53**:222-226, 1945.
36. Lundy, J. S., Touhy, E. B., Adams, R. C., Mousel, L. H., and Seldon, T. H. Annual report for 1944 of section on anesthesiology: including data and remarks concerning blood transfusion and use of blood substitutes. *Proc. Staff Meet., Mayo Clin.* **20**:292-302, 1945.
37. Clagett, O. T. Surgical treatment of bronchiectasis. *Proc. Staff Meet., Mayo Clin.* **20**:23-25, 1945.
38. Smyth, C. J., and Billingslea, T. H. Treatment of lung abscesses with penicillin. *J. A. M. A.* **129**:1005-1010, 1945.
39. Valle, A. R. Lung abscess: analysis of 244 cases. *Surg., Gynec. & Obst.* **81**:278-286, 1945.
40. Sweet, R. H. Analysis of Massachusetts General Hospital cases of lung abscess from 1938 through 1942. *Surg., Gynec. & Obst.* **80**: 568-574, 1945.
41. Adams, R., and Ficarra, B. J. Hemoptysis: etiology, pathogenesis and treatment. *Lahey Clin. Bull.* **4**:110-115, 1945.
42. Abbott, O. A., and De Oliveira, H. R. Spontaneous pneumothoraces occurring in patients undergoing peroral endoscopy. *J. Thoracic Surg.* **14**:453-460, 1945.

CASE RECORDS OF THE MASSACHUSETTS GENERAL HOSPITAL

Weekly Clinicopathological Exercises

FOUNDED BY RICHARD C. CABOT

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CASE 32271

PRESENTATION OF CASE

A sixteen-year-old schoolgirl entered the hospital because of headache, photophobia, diplopia and mild tinnitus.

Thirty days before admission, during a lecture, the patient had a sudden frontal headache, which was the first severe headache she had ever had. Subsequently there were severe headaches lasting about five minutes each, with intervals of from five to ten minutes between them. The pain started in the forehead and radiated down the neck, shoulders and arms. Each attack was accompanied by a generalized sensation of warmth. A dull constant ache gradually developed between attacks. Twenty days before admission, glasses were prescribed. Four days later the patient noticed blurring of vision, and on the following day she felt nauseated and at the same time began to have double vision. On the next day there was an episode of vomiting, the only one during this illness. One week before admission she felt dizzy and unsteady on standing. Buzzing in the ears, excessive lacrimation and photophobia developed in the last four days.

On physical examination the patient was alert and oriented. The pupils were equal and measured 4 mm. They did not react to light but did react to convergence. There was a 15° limitation of abduction of the left eye. The diplopia disappeared when the patient looked 10° to the right. There was limitation of upward gaze, with the left eye elevating 10 to 15° better than the right. On extreme supraversion there was a strong, sudden convergence. The visual fields were normal. There was papilledema of 1 or 2 diopters on the right and 2 or 3 diopters on the left. There was slight vertigo. Flexion of the neck was moderately limited and painful. There was a positive Kernig sign. The tendon, abdominal and plantar reflexes were normal. Sensation was normal.

The temperature was 99°F., the pulse 82, and the respirations 22. The blood pressure was 115 systolic, 75 diastolic.

There were 14.5 gm. of hemoglobin per 100 cc. of blood. The white-cell count was 10,300, with 72 per cent neutrophils. The urine had a specific gravity of 1.021. There was a + test for albumin, and the sediment contained 20 white cells and a rare red cell per high-power field. The spinal fluid was under an initial pressure equivalent to 260 mm. of water, which fell to 150 mm. with removal of 10 cc. The fluid was clear and contained 124 red cells, 6 lymphocytes and 1 polymorphonuclear cell per cubic millimeter. The total protein was 36 mg. per 100 cc. The electroencephalogram was moderately abnormal, with suspicious activity on the left side that was thought to be slightly more marked toward the occiput, although a positive localization was not possible. X-ray examination of the skull was negative. The blood and spinal-fluid Hinton and Wassermann tests were negative.

On the fourth hospital day bilateral occipital burr holes were made. Immediately after operation, the patient was restless, had a severe headache and did not recognize people. Four hours later she suddenly stopped breathing.

DIFFERENTIAL DIAGNOSIS

DR. DAVID COGAN: As I read over this record, it seemed to me to include a number of red herrings, and I should like to go over it sequentially and analyze the symptoms and findings, eliminating the insignificant ones.

In the first place, we are told that this patient, a sixteen-year-old girl, had sudden spontaneous headache. In itself, that symptom suggests a rupture of a congenital aneurysm. Ordinarily aneurysm produces headaches that have a sudden onset, but I have seen patients in whom the recurrences took place at reasonably long intervals — a matter of days, not every five or ten minutes as in this case.

Casting about for other causes of intermittent severe headache, one must think of intermittent block of the aqueduct — something in the region of the anterior midbrain. In that connection it would be interesting to know if movements of the head precipitated the headache or relieved the headache, as it sometimes does when there is a ball-valve obstruction of the aqueduct.

The pain started in the forehead and radiated down the neck, shoulders and arms, all of which suggests nothing to me. The generalized sensation of warmth with the attacks is of interest. If there were other corroborative evidence, such a sensation would be suggestive of a diencephalic lesion. The rest of the history, including a note about vomiting and dizziness, is compatible with increased intracranial pressure, all of which, except for the photophobia, I do not know how to interpret.

Physical examination disclosed something definite: the pupils were equal, measured 4 mm. and did not react to light but did react to convergence. These

were not Argyll–Robertson pupils because of their size. A pupil of 4 mm. is normal for a sixteen-year-old person. If the pupils were typically Argyll–Robertson, they would be miotic, and if large they would be of unequal size and irregular. These normal-sized pupils, which reacted for near vision but not for light, are strongly indicative of a lesion in the region of the superior colliculus.

There was a 15° limitation of abduction of the left eye, which I assume was due to paralysis of the external rectus muscle, since we are told that diplopia disappeared when the patient looked 10° to the right. But in the presence of increased intracranial pressure an altered paralysis of the rectus means nothing so far as localization is concerned. Increased intracranial pressure alone can give weakness of the external rectus muscle, presumably through involvement of the sixth nerve as it angulates over the sphenoidal ridge.

Limitation of upward gaze is significant and goes with the type of pupils that she had, under the heading of Parinaud's syndrome, which is pathognomonic of a lesion in the region of the superior colliculus. The paralysis of upward gaze and the pupillary signs fit into the syndrome. The statement that the left eye elevated 10 to 15° better than the right is confusing to me, especially since the diplopia disappeared when the patient looked just 10° to the right. If the left eye showed a difference of 15° somewhat above the midline, I should expect vertical diplopia in the horizontal position.

FIGURE 1.

I am going to have the temerity to say that I think that observation may have been erroneous.

On extreme supraversion there was strong sudden convergence. That means on attempted extreme supraversion, because the patient had weakness of upward gaze. Sudden convergence is a reaction that occurs in people who attempt to do something that they cannot do. This patient attempted in vain to look up, and convergence is not an infrequent reaction under those circumstances and has no localizing significance.

The papilledema goes with increased intracranial pressure, which is also compatible with a lesion in the region of the superior colliculus obstructing the aqueduct. The slight vertigo, the flexion of the neck and the positive Kernig sign, I interpret as resulting from the increased intracranial pressure and as having no further significance. There was no evidence of meningitis or of tumor of the posterior fossa, which might cause these signs.

The neurologic examination was negative except for the eyes. The laboratory data are not helpful. The urine was not a catheterized specimen, and I assume that it was not significant. I was surprised that a lumbar puncture was done, in view of the apparent increased intracranial pressure, which was evident in the papilledema. The fluid was clear and contained 131 cells per cubic millimeter. I have been looking for other evidence of aneurysm, but in view of the fact that this fluid was not xanthochromic and the protein was normal, I shall interpret the cells as being incidental to the puncture. The electroencephalogram I take to be equivocal.

In summary, I believe that the signs point to a lesion in the region of the superior colliculus with increased intracranial pressure and no definite indication of the nature of the lesion, but in view of the increased intracranial pressure I think that the likeliest diagnosis is a tumor. The most frequent tumors of this region are pinealoma, teratoma of the pineal body, tuberculoma and glioma of the mesencephalon. In the cases that I have seen with this general syndrome, however, there were two patients with aneurysm who never came to autopsy, so that I do not know where the aneurysm was. But I am humbled in the suggestion that it was a tumor by the fact that there were these cases of aneurysm.

We are told that occipital burr holes were made; I am at a loss to understand why, since there was no evidence of subdural hematoma, and I am wondering if the burr holes were made preliminary to an air injection and why the results of this injection were not described. Certainly air injection in this case would have been most helpful, particularly air in the region of the third ventricle.

DR. CHARLES S. KUBIK: The lateral ventricles were tapped, but no air was put into them.

DR. COGAN: Death I assume to have been caused by a pressure cone. At least one other patient seen in this hospital four or five years ago with a pinealoma met death in a similar fashion from a pressure cone.

CLINICAL DIAGNOSIS

Midbrain tumor.

DR. COGAN'S DIAGNOSES

Lesion in the region of the superior colliculi (probably tumor, possibly aneurysm).

Pressure cone as cause of death.

ANATOMICAL DIAGNOSIS

Pinealoma.

PATHOLOGICAL DISCUSSION

DR. KUBIK: In the region between the quadrigeminal plate and the splenium of the corpus callosum, where the pineal gland would normally be situated, there was a soft, friable tumor mass, 2.5 cm.

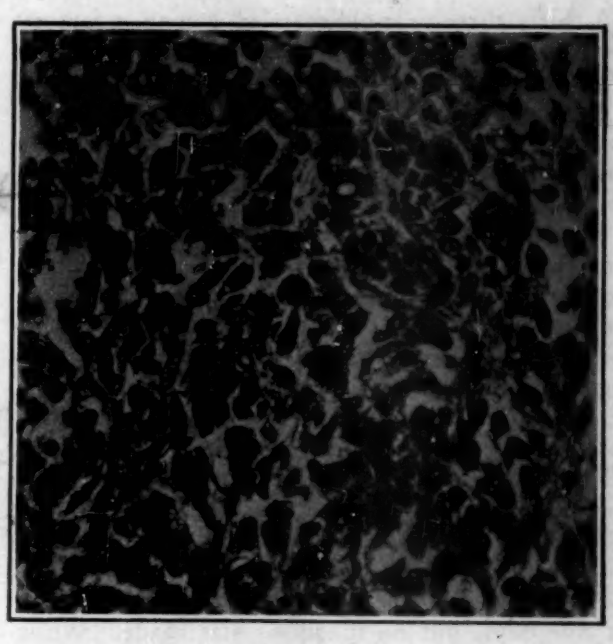

FIGURE 2.

to 3.0 cm. in diameter, which extended forward into the third ventricle. In this position it was situated between and invaded the posterior portions of the optic thalami. It also extended downward, invading the superior and inferior colliculi and the upper part of the tegmen of the pons. The aqueduct was partly occluded, and as a result the lateral ventricles were enlarged to three or four times their normal size (Fig. 1).

In cases of increased intracranial pressure in which death results from respiratory failure, a cerebellar

pressure cone is usually found at autopsy. The lower poles of the cerebellum and the medulla are forced downward into the foramen magnum, the herniated portions of the cerebellum forming a wedge that compresses the medulla and obliterates the blood supply of the respiratory center. In this case there was no pressure cone. It is possible, I suppose, that a high and rapid rise in intracranial pressure produces a similar effect on the respiratory center and results in death before any appreciable herniation of the cerebellum has taken place.

The tumor was composed of medium-sized, rounded and polyhedral pyramidal cells, some of which had well defined short cytoplasmic processes (Fig. 2). They bore a close resemblance to cells of the normal pineal gland. Scattered among the tumor cells were a few lymphocytes. In this respect the tumor differed from some of the other pinealomas examined here, in which there were large numbers of lymphocytes and plasma cells, not only in the tumor but also in the adjacent subarachnoid and perivascular spaces.

CASE 32272

Presentation of Case

A thirty-three-year-old married woman, a factory employee, entered the hospital because of intermittent fever.

Two years and eight months before admission the patient started working in a war plant. She was not exposed to any toxic substances. Six months later she began to have frequent colds and bouts of hoarseness. On one occasion she had a severe sore throat, with a temperature of 104°F. lasting for several days. During the succeeding six months she lost weight, had a poor appetite, and a dry hacking cough and worked only part time. She began to run an intermittent fever of 101 to 102°F. At that time a chest film was taken, and blood tests were performed; she did not know the results. All her teeth were removed. In the two years preceding admission she was constantly fatigued and had frequent chills and fever, usually accompanied by sweats at night. She lost 60 pounds. Her condition was studied at a community hospital for five days, but no diagnosis was made. While in the hospital she developed a boil on the buttock, which was lanced. At home she had three more boils, which ruptured and drained spontaneously. During the two months before admission a dull ache developed along the left costal margin in the midaxillary line. There was a sharp pain on coughing, with occasional vomiting after coughing. With the appearance of the ache, the temperature rose to 104°F. and remained elevated. Violent chills developed, and were accompanied by throbbing frontal headaches. During the chills the hands became white, and the fingertips blue. She fainted twice. During this illness, the menstrual periods gradually shortened to one day, and the flow was scanty. There were no other past illnesses. A former landlady with whom the patient had lived for two years had had cancer and possibly tuberculosis.

Fifteen and thirteen years prior to admission the patient underwent cesarean sections because of pelvic deformity from an automobile accident in childhood. The right ovary was removed at the second operation. Following this procedure a large abscess developed in the wound, taking four months to heal. Six years before admission she had an episode of severe lower abdominal pain and a vaginal discharge lasting four days.

On physical examination the patient was flushed and feverish. The heart sounds were forceful. There was a Grade II apical systolic murmur transmitted to the axilla and a Grade II pulmonic systolic murmur. The pulmonic second sound was greater than the aortic. Breath sounds, fremitus and voice sounds were absent over the entire left chest below the level of the eighth thoracic vertebra. The left diaphragm did not move. The whole area was tender. The left side of the abdomen was tender, with marked sensitivity in the upper quadrant. A mass in this region seemed to move on inspiration and was exquisitely tender. There was considerable voluntary spasm. The left vaginal vault was tender.

Examination of the blood showed a red-cell count of 3,100,000, with a hemoglobin of 8.5 gm. The white-cell count was 20,500 with 94 per cent neutrophils and a marked shift to the left. The urine had a specific gravity of 1.003. There was a ++ test for albumin. The sediment contained 200 to 400 white cells in clumps per high-power field.

X-ray examination showed the right side of the chest to be normal. The left leaf of the diaphragm was elevated and limited in motion. There were linear areas of atelectasis above the diaphragm. The heart was normal. A large tumor mass in the left upper quadrant, measuring approximately 10 by 14 cm. in diameter, seemed to occupy the site of the left kidney. The corrected sedimentation rate was 1.3 mm. per minute. The tuberculin test was positive in a dilution of 1:100,000. A phenolsulfonephthalein test showed 85 per cent excretion of the dye in two hours. No dye was excreted by the left kidney after intravenous pyelography. Abundant beta-hemolytic streptococci were cultured from the urine. The blood culture was negative. Serum agglutination tests for the typhoid-paratyphoid group of organisms and for Brucella were negative. An electrocardiogram was normal.

An operation was performed on the sixth hospital day.

Differential Diagnosis

Dr. Wyland F. Leadbetter: We are dealing with the illness of a thirty-three-year-old woman,

which presumably began about two years before admission to the hospital. The illness was characterized by intermittent attacks of chills and fever, as well as loss of weight and appetite, and was punctuated by at least one episode of severe sore throat, with a temperature of 104°F. At one time all her teeth were removed, presumably following search for foci of infection. She developed a series of boils, which probably have no bearing on the subsequent course of the case, although this fact should be kept in mind. She was admitted to a hospital for five days during a period when she was having chills and fever, but no explanation for the symptoms was made. She had at times had a dry cough, not a productive cough, if one can trust the history. Two months before admission to this hospital she had localizing signs for the first time. She began to develop pain and discomfort in the left upper abdomen and left flank, and reported the development of a persistent temperature, which was stated to have reached 104°F. and to have remained at that level. On admission to the hospital she was obviously very sick. There was absence of breath sounds in the left chest below the eighth rib. There was tenderness in the left upper abdomen and flank, and an obvious mass could be felt in this area. She had a rather marked secondary anemia, and a white-cell count of 20,500, with 94 per cent neutrophils. The urine showed a specific gravity of 1.003, which I think is of no significance, because we do not know under what conditions it was obtained. There was a ++ test for albumin, and the urinary sediment showed 200 to 400 white cells per high-power field — in other words, there was a marked pyuria.

An x-ray film showed a clear right chest, an elevation of the diaphragm on the left, with limitation of motion, and evidence of atelectasis in the left lower lung, presumably due to pressure from the mass below the diaphragm. A plain x-ray film of the abdomen is said to have shown a large tumor mass measuring 10 by 14 cm. I should think that that was not an unusually large tumor mass, particularly if it was associated with the kidney. A tuberculin test was positive in a dilution of 1:100,000. A phenolsulfonephthalein test showed 85 per cent excretion in two hours, which I presume was considered normal. An intravenous pyelogram showed no dye coming through the left kidney. I think that we can assume that the right kidney was normal. Interestingly enough, abundant beta-hemolytic streptococci were cultured from the urine. Although such a finding is not rare, it is difficult to explain this woman's symptoms on such a basis. A blood culture was negative. I assume that the question of subacute bacterial endocarditis came up. The negative culture may be considered to rule it out. Agglutination tests for typhoid, paratyphoid and brucellar organisms were negative. The electrocardiogram was normal.

On physical examination the patient had evidence of systolic apical and pulmonic murmurs. In view of the long illness and secondary anemia, I assume that those could be considered to be hemic murmurs and that increased intrapulmonic pressure might have caused accentuation of the pulmonic second sound.

Before we go any farther I think that it would be of interest to see the x-ray films. It should be quite simple to arrive at a definite diagnosis in this case, provided that there is a good pyelogram. We can assume that the difficulties of this patient were localized in the left kidney because of the mass in that region, the fever, the elevated white-cell count, the pyuria and the nonfunctioning left kidney.

DR. JAMES R. LINGLEY: This film shows the high left diaphragm. The density in the lower lung field is, I think, quite consistent with atelectasis. This plain film of the abdomen shows a large mass on the left side, which has the shape of the kidney, and on the intravenous pyelogram there is evidence of excretion on the right side and the pelvis and calyxes on that side are somewhat elongated. On the left side there is no evidence of excretion.

DR. LEADBETTER: There is no evidence of a perinephric mass?

DR. LINGLEY: No.

DR. LEADBETTER: A retrograde pyelogram of the left kidney would have been helpful, because there are a good many possibilities. I think that it is impossible to arrive at a specific diagnosis other than to assume that the patient had an enlarged left kidney, pyuria, with an elevated temperature, and presumably pyonephrosis. This was a long-standing illness, and if we assume that the illness over a period of two years was due to infection in the left kidney, extension to the perinephric tissues or the development of an actual perinephric abscess would not be unusual at this late date. However, I think that the x-ray film does not suggest any evidence of a perinephric abscess, and we are forced to assume that she had a pyonephrosis and preceding that a pyelonephritis that was active at intervals, at least over a two-year period. The possibility of a carbuncle of the kidney should be mentioned, I suppose, but I should stress the fact, if the culture report is to be trusted, that beta-hemolytic streptococci would probably not cause an abscess so frequently as staphylococci, and I believe that this woman probably did not have a carbuncle of the kidney or a perinephric abscess.

Assuming that the woman did have a pyonephrosis, one must trace the development of the process and try to determine why she ended up with this particular picture. Infection of both kidneys is usually the result either of introduction of infection from below or of transmission of infection to the kidneys by way of the blood stream. We know that when an infection persists in the kidney it is usually the result of obstruction to the outflow of

urine from that kidney. I therefore think that we can assume that this woman had some sort of obstructive lesion involving the ureteropelvic junction, the ureter or the terminal portion of the ureter in the bladder, and I see no way of arriving at a definite opinion regarding the location of the obstruction. Obstruction is most frequent at the ureteropelvic junction. On the other hand several things in the history suggest another point of obstruction in this case. Fifteen and again thirteen years before admission to the hospital she had cesarean sections, and following the last section, when an ovary was removed, the wound became infected and drained for four months. We have no record of whether the drainage contained purulent material or urine, but it is possible that this woman had an inflammatory reaction in the pelvis, with periureteritis, which subsequently caused constriction of the lower ureter. Going back still farther in the history we find that as a child she was injured in an automobile accident and presumably suffered a fractured pelvis. There may have been a retroperitoneal hematoma at that time which involved the ureter. Possibly there may have been a congenital stricture of the ureter.

Finally, one other diagnosis that should be considered is tuberculosis, because it is not unusual for a chronic renal tuberculosis to result in stricture of the ureter as an extension of a tuberculous pyelonephritis or for a tuberculous kidney to be infected secondarily with other organisms. There is no way of determining this from a standpoint of reasoning, and I simply point out the fact that there are several possibilities: stricture of the ureter on the basis of injury, on the basis of old infection, possibly on the basis of tuberculosis or on the basis of congenital abnormality of the ureteropelvic junction. I think that the final episode was the development of a pyonephrosis in which beta-hemolytic streptococci may have been the infecting organisms.

Clinical Diagnosis

Carbuncle of kidney.

Dr. Leadbetter's Diagnosis

Pyonephrosis, left.

Anatomical Diagnoses

Tuberculosis of kidney.
Tuberculous peritonitis.

Pathological Discussion

Dr. Tracy B. Mallory: The preoperative diagnosis was a carbuncle of the kidney. An exploration of the kidney was done, extensive perirenal infection was found and drainage was instituted. At a subsequent operation an attempt was made to remove the kidney, but the disease had already progressed beyond practical operability. It was necessary to remove a considerable portion of the diaphragm and the adrenal gland on that side. The kidney and surrounding tissues showed massive tuberculosis. There was no gross evidence of abscess formation. The patient died some weeks later of tuberculous peritonitis.

Dr. Leadbetter: I should like to point out that chills and fever are extremely rare in renal tuberculosis. In fact it is the exception rather than the rule for a patient with pure renal tuberculosis to have fever of any considerable degree.

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POLITICS AND THE PUBLIC HEALTH

The administration of a department of health in any large community has become a highly complex problem. It is a professional task requiring considerable training and experience in many and varied fields. The need for such training has given rise to several professional schools in which the curriculum is designed especially for graduates in medicine and and for others interested in certain narrower technical fields to prepare them for a career in the control and prevention of disease.

In recent years some legislative bodies have become cognizant of these needs for training and experience in the protection of the public health. They have therefore incorporated into the laws governing the choice of public-health administrators certain provisions intended to safeguard the public against arbitrary appointments made solely for political expediency rather than for the health and welfare of the people. The requirements in training and experience for these positions are usually made rather exacting, and provisions are also included for consultations with leading authorities within the profession for advice and guidance.

The maintenance and advance of public health is in itself a potent political weapon and in the hands of capable and high-minded chief executives has been encouraged and used to the best advantage. This has meant a careful search for the best talent available, as well as the vigorous support of the chosen servants in the fulfillment of their tasks. It has also been necessary to resist all temptation to yield to pressures to choose politically favored but unqualified or mediocre candidates instead of those best qualified for the task. The recognition of these principles has resulted in the development of outstanding departments of public health in several states and cities, and these in turn have led the country in advancing the health and welfare of its citizens.

Unfortunately, changes in political tides have often brought with them elected representatives of the people who place political interests ahead of the public health and welfare. In so doing, they flout the advice and counsel of leaders in the field of public health and choose their supporters or friends to head the health services of their communities. This has invariably resulted not only in an arrest of progress but also in a deterioration, if not destruction, of the work so tediously and conscientiously built up by their capable predecessors. Not so many years ago Massachusetts went through an experience of this sort, and recently the newly elected mayor of New York City, ignoring and brushing aside the judgment and recommendations of his city's and some of the country's leading authorities, made a purely political appointment, which certainly cannot be construed as following the intent of the law concerning training and experience in public health. It is a great pity that the devoted and conscientious labors that his predecessors in office put into the

maintenance of a high standard in personnel and in performance in New York City's health services should be treated with so little respect and consideration.

In New York City, the forces of medical authority and of general opinion in the field of public health sometimes break through political pressures, at least to the point of being articulate in their criticism and in placing the facts before the public. These combined forces resulted in the resignation of the mayor's first appointee, and another attempt was made to obtain a suitable candidate for the position. It was hoped that this time the carefully considered opinion of a committee of recognized experts would not be flouted. But politicians, when they are obviously in error, have an uncanny way of compromising by substituting subservient mediocrity for competent but militant and progressive leadership. Such apparently was the case in the mayor's final choice.* How this will affect the high quality of health services to which the people have become accustomed and what this implies in terms of the health of the people of America's largest city remain to be seen.

*Deutsch, A. Hacks run C. H. D. as O'Dwyer rejects top expert. *P. M.* (June 5, 1946).

AVITAMINOSES AND HYPOPROTEINEMIA IN STARVATION

WAR is invariably followed by famine, and advantage of this unfortunate by-product has already been taken by a number of physicians and biochemists interested in nutrition. A few preliminary studies of starvation in occupied countries have appeared,[1, 2] and it is hoped that the complete reports will soon be published. Severe starvation in prison camps was seen throughout the world and is the subject of a report by Butler, Ruffin, Sniffen and Wickson,[3] who examined civilians after their release from Japanese camps. These reports contain a number of interesting and significant observations.

As would be expected, loss of weight was usually severe. For example, Butler et al. reported average losses of 30 pounds for women and 50 pounds for men after three years of internment. In Rotterdam, the average weight loss was 25 pounds.[1]

Evidence of gross manifestations of vitamin deficiency was surprisingly uncommon; in fact, with the exception of occasional reports of specific deficiencies, such as those described by Butler et al., they were not observed. Several explanations for this have been suggested. One is that most of the food eaten was unrefined. Thus, in Europe, bread made from coarse flour that contained an assortment of the components of the vitamin B complex, including thiamine, was the staple. On the contrary, polished rice was a principal article of diet of the Japanese prisoners, which may have accounted in part for the evidence of thiamine deficiency that was observed in this group. It is probable that the appearance of a greater number of symptoms and signs of deficiency was prevented by the low caloric value of the food eaten, with an attendant reduction in metabolism, which, in turn, decreased the vitamin requirements.

The incidence of so-called "hunger edema" was high in all the reports. Undoubtedly, in many cases this was due to hypoproteinemia and a consequent reduction in serum osmotic pressure, and in others, especially those studied by Butler et al., to thiamine deficiency. Nevertheless, a significant number of persons with edema were observed in whom the serum protein concentrations were normal and no evidence of thiamine deficiency was apparent. This was true in Holland, where both the albumin and the globulin were determined.[1] In Belgium, Gounelle[4] reported 17 cases of edema with serum albumin levels of 4.5 to 5.0 gm. per 100 cc. Govaerts and Lequime[5] studied the serum albumin concentration and osmotic pressure in several cases of this condition and found that the latter was reduced out of all proportion to the former, which was either normal or moderately reduced. Govaerts and Lequime admit that it is difficult to interpret these findings but suggest that reduced tissue osmotic pressure may contribute to edema formation in persons suffering from starvation. Such observations suggest that the Starling hypothesis may not entirely account for "hunger edema." It is apparent that further studies, especially those using new tools, such as the ultracentrifuge and electrophoresis, must be devised to determine the mechanism of edema formation in starvation.

References

1. Stare, F. J. Nutritional conditions in Holland. *Nutrition Rev.* 3:225-227, 1945.
2. Editorial. Undernutrition in Belgium. *Brit. M. J.* 2:694 1945.
3. Butler, A. M., Ruffin, J. M., Sniffen, M. M., and Wickson, M. E., Nutritional status of civilians rescued from Japanese prison camps. *New Eng. J. Med.* 233:639-652, 1945.
4. Gounelle, H. Sur la pathogenie des oedemes de denutrition par carence alimentaire. *Semaine d. hôp. de Paris* 43:1209-1211, 1945.
5. Govaerts, P., and Lequime, J. Quoted by Gounelle.[4]

MASSACHUSETTS MEDICAL SOCIETY

DEATH

ADAMS — Charles S. Adams, M.D., of Wollaston, died June 13. He was in his seventy-eighth year.

Dr. Adams received his degree from Harvard Medical School in 1894. He was a former president of the Norfolk District Medical Society and a fellow of the American Medical Association.

His widow and two daughters survive.

MASSACHUSETTS DEPARTMENT OF PUBLIC HEALTH

CONGENITAL DEFECTS DUE TO RUBELLA

The status of rubella as a completely benign childhood disease was abruptly altered in 1941, when Gregg reported some unusual findings from Australia. Following an uncommonly large epidemic of rubella, numerous women were delivered of infants in whom various congenital defects were observed. These defects included cataracts and other ocular malformations, deafness, heart defects and defects of the head and extremities. Other investigations substantiated these early findings, but the magnitude of the problem has not yet been determined.

At present, the Department of Public Health is undertaking a survey to determine whether or not rubella produces similar effects in Massachusetts and, if so, how extensive the problem is. The year 1943, which is relatively recent and in which a total of nearly 35,000 cases of rubella were reported, was selected for study. Questionnaires are being prepared to go to all physicians in the Commonwealth. Descriptive pamphlets and questionnaires will subsequently be sent to each woman, seventeen to forty-nine years of age, reported as having rubella during 1943. The following data are desired: the trimester of pregnancy in which the mother became ill; whether there was subsequently a miscarriage, premature delivery or full-term delivery; and whether the infant was normal or demonstrated any congenital defects. Negative reports are as essential as positive reports, to establish a comparison.

Although 1943 was primarily selected for study, the Department is interested in receiving any information pertaining to this problem, regardless of the date. It is essential to establish not only the fact of the condition but also its incidence. Data from all interested physicians, hospitals, schools and other institutions will be welcome.

COMMUNICABLE DISEASES IN MASSACHUSETTS FOR MAY, 1946

Résumé

Diseases	May 1946	May 1945	Seven-Year Median
Anterior poliomyelitis	1	1	1
Chancroid	4	1	*
Chicken pox	2248	1122	1207
Diphtheria	22	14	14
Dog bite	1450	1289	1335
Dysentery, bacillary	5	19	12
German measles	1470	167	382
Gonorrhea	340	484	358
Granuloma inguinale	0	2	*
Lymphogranuloma venereum	0	3	*
Malaria	68	146	1
Measles	11501	996	4209
Meningitis, meningococcal	8	16	16
Meningitis, Pfeiffer-bacillus	1	1	2
Meningitis, pneumococcal	4	7	7†
Meningitis, staphylococcal	0	0	0†
Meningitis, streptococcal	0	3	2†
Meningitis, other forms	2	0	1†
Meningitis, undetermined	4	2	11†
Mumps	922	2222	1459
Pneumonia, lobar	117	261	261
Salmonella infections	3	3	6
Scarlet fever	856	1521	1120
Syphilis	439	388	462
Tuberculosis, pulmonary	390	306	303
Tuberculosis, other forms	25	18	23
Typhoid fever	2	0	2
Undulant fever	6	2	4
Whooping cough	574	670	671

*Made reportable December, 1943.
†Four-year average.

Comment

Diseases reported at figures above the seven-year median included diphtheria, German measles, undulant fever, chicken pox and measles. The last-named established a new record for this disease for the month, whereas chicken pox reached its second highest peak, the highest having been recorded in 1944.

Among diseases reported below the seven-year median were bacillary dysentery, meningococcal meningitis, mumps, scarlet fever and whooping cough.

Lobar pneumonia was again reported at a record low for the fourth successive month.

Geographical Distribution of Certain Diseases

Anterior poliomyelitis was reported from: Haverhill, 1; total, 1.

Anthrax was reported from: Boston, 1; total, 1.

Diphtheria was reported from: Boston, 2; Brockton, 5; Brookline, 1; Cambridge, 1; Chelsea, 2; Everett, 1; Gloucester, 1; Haverhill, 1; Lynn, 1; Medford, 1; Shirley, 1; Millis, 1; Taunton, 4; total, 22.

Dysentery, bacillary, was reported from: Grafton (State Hospital), 3; Tewksbury State Infirmary, 1; Milton, 1; total, 5.

Hookworm was reported from: Lynn, 1; total, 1.

Malaria was reported from: Abington, 1; Belmont, 1; Boston, 16; Brockton, 2; Brookline, 1; Cambridge, 3; Chelsea, 1; Clinton, 1; Gloucester, 1; Grafton, 1; Haverhill, 1; Hudson, 1; Lawrence, 1; Lowell, 1; Lynn, 1; Malden, 3; Medford, 3; Milton, 1; Newton, 1; Peabody, 1; Plymouth, 1; Quincy, 1; Revere, 2; Seekonk, 1; Somerville, 2; Southbridge, 1; Taunton, 1; Templeton, 1; Waltham Regional Hospital, 2; Watertown, 1; West Springfield, 3; Westwood, 2; Winchendon, 1; Winthrop, 1; Woburn, 4; Worcester, 2; total, 68.

Meningitis, meningococcal, was reported from: Boston, 1; Franklin, 1; Lowell, 2; Malden, 1; Marblehead, 1; Quincy, 1; Weymouth, 1; total, 8.

Meningitis, Pfeiffer-bacillus, was reported from: North Adams, 1; total, 1.

Meningitis, pneumococcal, was reported from: Cambridge, 2; Fitchburg, 1; Lynn, 1; total, 4.

Meningitis, other forms, was reported from: Boston, 1; Winthrop, 1; total, 2.

Meningitis, undetermined, was reported from: Chicopee, 1; Palmer, 1; Pittsfield, 1; Worcester, 1; total, 4.

Salmonella infections were reported from: Lawrence, 1; Peabody, 1; Salem, 1; total, 3.

Septic sore throat was reported from: Boston, 5; Haverhill, 2; Holbrook, 1; Medford, 1; Quincy, 1; Springfield, 1; Westford, 2; total, 13.

Tetanus was reported from: Chelsea, 1; West Springfield, 1; total, 2.

Trichinosis was reported from: Medford, 1; New Bedford, 1; total, 2.

Typhoid fever was reported from: Springfield, 1; Worcester, 1; total, 2.

Undulant fever was reported from: Adams, 1; Ashland, 1; Billerica, 1; Newton, 1; Quincy, 1; Southboro, 1; total, 6.

MISCELLANY

Dr. Harold J. Jeghers, formerly associate professor of medicine at Boston University School of Medicine and a member of the staffs of the Boston City Hospital and Evans Memorial, Massachusetts Memorial Hospitals, has recently been appointed professor of medicine and director of the Georgetown University School of Medicine. He has also become physician-in-chief at the Georgetown University Hospital.

BOOKS RECEIVED

The receipt of the following books is acknowledged, and this listing must be regarded as a sufficient return for the courtesy of the sender. Books that appear to be of particular interest will be reviewed as space permits. Additional information in regard to all listed books will be gladly furnished on request.

Essentials of Body Mechanics in Health and Disease. By Joel E. Goldthwait, M.D., LL.D., Lloyd T. Brown, M.D., Loring T. Swaim, M.D., and John G. Kuhns, M.D. With a chapter "The Heart and Circulation as Related to Body Mechanics" by William J. Kerr, M.D. Fourth edition. 12°, cloth, 337 pp., with 128 illustrations. Philadelphia: J. B. Lippincott Company, 1945. $5.00.

The first three editions of this authoritative manual were published under the title *Body Mechanics in Health and Disease.* The fourth edition has been carefully revised and partially rewritten. The chapter on disabilities of the feet has been entirely rewritten, and new chapters on geriatrics and on the heart and circulation have been added. The illustrations have been augmented, and an extensive bibliography is appended to the text. In this edition emphasis is placed on the maintenance of physical fitness and health and on the prevention of many deformities due to faulty body mechanics.

NOTICES

ANNOUNCEMENTS

Dr. Edward A. Adams announces that after June 1, 1946, his practice will be limited to general surgery and consultation at 44 Oliver Street, Fitchburg.

Dr. William Corwin announces the opening of an office for the practice of psychiatry and neurology at 95 State Street, Springfield.

Dr. J. Edward Flynn announces his release from military service and the reopening of his office for the practice of surgery at 475 Commonwealth Avenue, Boston.

Dr. Arthur J. Gorney announces his return to the practice of otolaryngology and related plastic surgery at 14 Charlesgate West, Boston.

Dr. Patrick J. Mahoney is resuming practice at 96 Bay State Road, Boston.

Dr. Jacob Mezer, having returned from military service, announces the opening of his office for the practice of gynecology and obstetrics at 171 Bay State Road, Boston.

Dr. John P. Rattigan announces his return from service in the U. S. Naval Medical Corps and the opening of his office for the practice of internal medicine at 422 Beacon Street, Boston.

Dr. Benjamin Tenney announces his return from military service to the practice of gynecology and obstetrics at 330 Dartmouth Street, Boston.

AMERICAN BOARD OF OBSTETRICS AND GYNECOLOGY

The annual meeting of the American Board of Obstetrics and Gynecology was held in Chicago, Illinois, from May 5 to May 11, 1946, at which time one hundred and forty-one candidates were certified.

A number of changes in Board regulations and requirements were put into effect. Among these is the requirement that case records must now be forwarded to the Secretary's Office from thirty to sixty days after the candidate has received notice of his eligibility for admission to the examinations for certification. At this meeting the Board also ruled that it will not accept the nine months' residency as an academic year toward years of training requirements following the termination of the official period of intern and residency acceleration, April 1, 1946.

The next written examination (Part I) for all candidates will be held in various cities of the United States and Canada on Friday, February 7, 1947, at 2:00 p.m. Candidates in military service are requested to keep the Secretary's Office closely informed of changes in address.

Applications are now being received for the 1947 examinations. The closing date for these applications will be November 1, 1946.

For further information and application blanks, address Dr. Paul Titus, Secretary, 1015 Highland Building, Pittsburgh, 6.

SOCIETY MEETINGS AND CONFERENCES

Calendar of Boston District for the Week Beginning Thursday, July 11

Friday, July 12

*10:00 a.m.–12:00 m. Medical Staff Rounds. Peter Bent Brigham Hospital.

12:00 m.–1:00 p.m. Clinicopathological Conference (Boston Floating Hospital). Joseph H. Pratt Diagnostic Hospital.

Tuesday, July 16

*12:15–1:15 p.m. Clinicoroentgenological Conference. Peter Bent Brigham Hospital.

Wednesday, July 17

*10:30–11:30 a.m. Medical Clinic. Isolation Building Amphitheater, Children's Hospital.

*12:00 m. Clinicopathological Conference. (Children's Hospital.) Amphitheater, Peter Bent Brigham Hospital.

*2:30–4:00 p.m. Combined Clinic by the Medical, Surgical and Orthopedic Services. Amphitheater, Children's Hospital.

*Open to the medical profession.

March 15–September 15. Boston University Course for Discharged Medical Officers. Page 240, issue of February 14.

July 9. New England Hospital for Women and Children. Page 878, issue of June 27.

September 4–7. American Congress of Physical Medicine. Page 616, issue of May 2.

September 30–October 3. Industrial Health Congress. Page 878, issue of June 27.

October 6–12. Interamerican Congress of Cardiology. Page xix, issue of June 6.

October 7–18. New York Academy of Medicine. Page 544, issue of April 18.

February 7. American Board of Obstetrics and Gynecology. Notice above.

District Medical Society

PLYMOUTH

October. Jordan Hospital, Plymouth.

November. Plymouth County Hospital, South Hanson.

January. Brockton Hospital, Brockton.

February. Moore Hospital, Brockton.

March. Goddard Hospital, Brockton.

April. State Farm, Bridgewater.

May. Lakeville Sanatorium, Lakeville.